ISEA2018

DURBAN SOUTH AFRICA

INTERNATIONAL SYMPOSIUM ON ELECTRONIC ART

DUT DURBAN UNIVERSITY OF TECHNOLOGY

DIGI FEST

IF INNOVATION FESTIVAL DURBAN

INTERFERENCES

ACADEMIC PROCEEDINGS

Proceedings of the 24th International Symposium on Electronic Art.

Editorial Coordinators: Rufus Adebayo, Ismail Farouk, Steve Jones, Maleshoane Rapeane-Mathonsi,

Image Design ISEA2018: Faculty of Arts and Design

Cover Design: Thabiso Radebe (DUT)

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ISBN: 978-0-620-80332-8

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PRESENTATION

The 24th International Symposium on Electronic Art (ISEA2018) will be hosted in sub-Saharan Africa for the very first time, thanks to Durban University of Technology (DUT), eThekwini Municipality, KZN Convention Bureau, Innovate Durban and The Trinity Session. ISEA2018 presents a culmination of collective efforts from a range of individuals, across disciplines, committed to electronic arts and design.

DUT's Faculty of Arts and Design, the home of Digifest, is pleased to co-host ISEA2018. City Campus, with its rich history, is itself an intersection of heritage, tradition, innovation and the future, intersecting with highways and throughways, public and private spaces; immersed in a confluence of cultures, communities and activities. Our inner–city university campus provides an engaging space for experimental, innovative work from emerging digital artists, and our Arts and Design Digital Festival (Digifest) provides a platform for engagement.

Digifest was approached to be involved in ISEA2018, to engage with international scholars and practicing electronic artists, so as to enhance and grow our Durban festival. Rooted in a University with direct links to industry and the city, Digifest is committed to providing students with a platform to experiment and showcase their work. We are pleased to present a selection of our interdisciplinary, collaborative Digifest-incubated projects at ISEA2018. Our Digifest App and various design and layout contributions to ISEA2018 are all the work of DUT students and graduates. We are pleased to have been selected as an ISEA2018 legacy project and hope to draw on partnerships to consolidate and sustain our local festival.

René Alicia Smith, PhD

Executive Dean: Faculty of Arts and Design, Durban University of Technology
ISEA2018 Academic Director and Digifest Director

PREFACE

The overall theme of this year's ISEA, Intersections, allows for a reflection and engagement on the transformative nature of art and its convergence with science and technology.

In conceptualisng the ISEA2018 experience we were guided by ISEA International requirements for a localised festival, offering unique experiences of an interdisciplinary symposium, comprising "an academic conference, art exhibitions, performances, public events, and related activities", as well as incorporating "aspects of local culture, history and traditions".

We are located at intersections of African and colonial heritage; first and 'second' economies; local and international cultures; simulated and lived experiences. ISEA2018 provides a platform for encounters and interaction with innovation and activist engagement in public and private spaces. Symposium subthemes include: hybridisation and purity; emancipation and pain; spirit and flesh and in-between the cracks and submissions explore (amongst others) art interfacing with networks, urbanisation and social justice. Significantly, we find ourselves at the intersection of ISEA2017 in Manizales, Colombia where the focus was on critical considerations vis-à-vis Bio Creation and Peace and ISEA2019, which takes place in Seoul.

The overall programme design of ISEA2018 is based on feedback from previous ISEA experiences and guidelines from ISEA international. The final list of Keynotes prioritises inclusivity and these proceedings are equally reflective of the diversity of voices from the global south and north. A total of 281 submissions for papers, posters, panels and roundtables were received via EasyChair. A double-blind peer review process culminated in the selection of papers for ISEA2018 proceedings.

A special thank you to all contributors, IPC members and to the ISEA Board - including its Executive Director who helped guide us on our journey to ISEA2018.

ISEA2018 Academic Committee

Dr Rufus Adebayo, Ismail Farouk, Dr Maleshoane Rapeane-Mathonsi, Prof Richard Millham and Dr René Smith.

SUB-THEMES

Hybridisation and Purity:
The sub-theme provides for contributions reflecting the purity of numbers, code and technology interfacing with art, as well as hybridisation in relation to art, science and technology. This sub-theme includes contributions on identities, diversity and pluralism, migration and urbanisation as well as notions of democracies - all in relation to art, science and technology.

Emancipation and Pain:
The sub-theme provides for contributions on the politics of art, science and technology in its broadest sense. This includes critical assessments on surveillance and intelligence; 'high art'; elitism and exclusivity, popular culture and inclusivity.

Spirit and Flesh:
The sub-theme provides for contributions on intangible and tangible heritage; on mobius and teleos; as well as indigenous knowledge systems, reality and lived experiences. It also includes contributions on the self and the body as well as on infinity and life beyond.

In between the cracks:
The sub-theme allows for contributions on anything in-between; which do not fit into identified sub-themes, and that push the boundaries of art, science and technology. Individual scholars and artists, as well as those working in groups are welcome to propose sessions, events, roundtables, exhibitions and performances which go beyond the suggested themes and which seek to enhance the overall conference experience

TABLE OF CONTENTS

SHORT PAPERS

PANELS

A Flexible Approach for the Application of Immersive Audio to an Installation Performance

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Abstract

This paper investigates the use of the ImmerGo spatial audio system and Ethernet AVB as a platform for the creation and deployment of immersive audio content. An analysis of Ethernet AVB and ImmerGo's features is given. This is followed by a practical implementation of ImmerGo within an installation setting of a choreographed performance. This approach provided key features such as user control from a mobile device to render positions of audio tracks and control DAW transport. The Ethernet AVB network allowed for real-time synchronized audio streaming, audio device interoperability, distributed endpoint processing and simple audio routing schemes.

Keywords

Immersive installation, Object based audio, mobile device control, distributed processing, spatial audio rendering algorithms, networked audio, Ethernet Audio Video Bridging, applied research, live sound engineering.

Introduction

Immersive audio within mixed media performance and installations has become a popular topic in recent years. Many artists would like their work to be enhanced by multichannel sound systems. Unfortunately these systems can become large which make them hard to manage and maintain, as well as very costly. Adding to the complication, a multitude of devices may need to be connected to mixing desks and multi I/O converters prior to even being able to play audio to the sound system. This requires large front of house areas to house the equipment during the performance. These complex signal paths and their control can stall the creative process when audio engineers mix for these events.

This paper investigates the ImmerGo spatial audio system [1] and Ethernet Audio Video Bridging (AVB) [2] as a basis for a versatile audio system that is easily scalable and controllable. It may be used to aid the mixing process for multichannel audio installations. The system is designed to reduce laborious routing procedures and makes use of distributed end-point processing for spatial audio rendering. This allows an engineer to efficiently manage the setup and control of a multichannel spatial audio system. A practical use of this system is demonstrated which shows these two technologies working together to provide a framework with which to create immersive audio content efficiently and deploy it effectively.

The subsequent sections proceed as follows. First, there is a brief description of the Ethernet AVB specification with a focus on device interoperability. Following this, there is a short explanation of the ImmerGo framework and it's AVBenabled features. Lastly there is a practical example of an installation that demonstrates these technologies.

Ethernet AVB

The Ethernet AVB (Audio Video Bridging) standard [3] is an open IEEE standard networked audio solution. It is built on current IEEE 802 Time-Sensitive Networking protocols by the IEEE 802.1 Audio/Video bridging task group. It allows for real-time media transmission over an Ethernet network that ensures appropriate Quality of Service (QoS) delivery by determining worst case delay times for network transmission and media input and output buffering. It also provides a mechanism to enable simple connection management and control of any AVB-capable devices and being an open standard it enables adoption by different manufacturers. The standard makes use of specific network switches that handle specific network traffic and time synchronization for media transmission.

The standard's media encapsulation model allows for the streaming of uncompressed, synchronized audio to devices on the network with low latency. It's device description model, known as the AVDECC Entity Model (AEM), enables device interoperability. These models provide the capability of streaming audio to devices while also controlling them from other end-points on the network. A number of different manufacturers have already developed AVB compliant audio interfaces that are able to communicate with one another using the protocol.

How AVB works

Typically, AVB devices are labelled as either listener, talker or both. Listeners have the sole purpose of receiving incoming audio streams from the network. Talkers are able to send audio streams to the network. Talkers stream

media to specific listeners using the 1722 Audio Video Transport protocol [4]. Each device has a MAC address which is used to create it's AVB specific entity ID and makes it individually addressable on the network.

The control protocol of the Ethernet AVB specification is the 1722.1 AVDECC (Audio Video Discovery Enumeration Connection management and Control) protocol [5]. This protocol provides the ability for devices to make themselves and their control parameters discoverable on the AVB network. Once these devices are discovered, stream connections may be created and devices can send control requests to one another. The device specific parameter controls are described within the AEM of each device.

For any AVB-capable device to make effective use of these protocols, they must first all be connected to an Ethernet AVB-enabled switch. This switch has firmware which is designed to the Ethernet AVB specification and performs traffic shaping, precision timing and stream reservation of the bandwidth thereby providing the QoS necessary for real-time transmission. This QoS ensures that all media transmission is deterministic and has low-latency.

A diagram of a typical Ethernet AVB network is shown in figure 1.

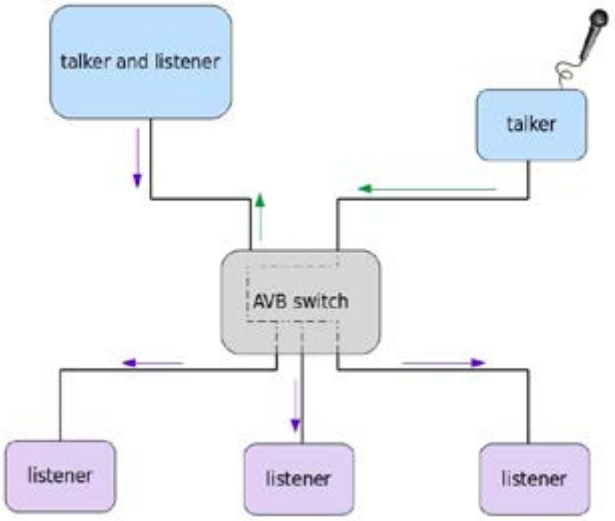


Fig. 1: *A typical AVB network. Purple arrows correlate to audio streamed directly to listeners attached to speaker outputs. The green routing path correlates to audio sent from one AVB device to another before being streamed to those same listeners.*

Figure 1 indicates that an AVB device is able to act as both a talker and listener at the same time. Specifically this means the device would be able to retrieve audio streams, and further stream them to other devices on the network. These stream connections may be controlled via an AVDECC connection matrix as shown in figure 2. This connection matrix software will then generate appropriate AVDECC connection commands for devices being connected.

Figure 2 shows a connection matrix with 4 devices

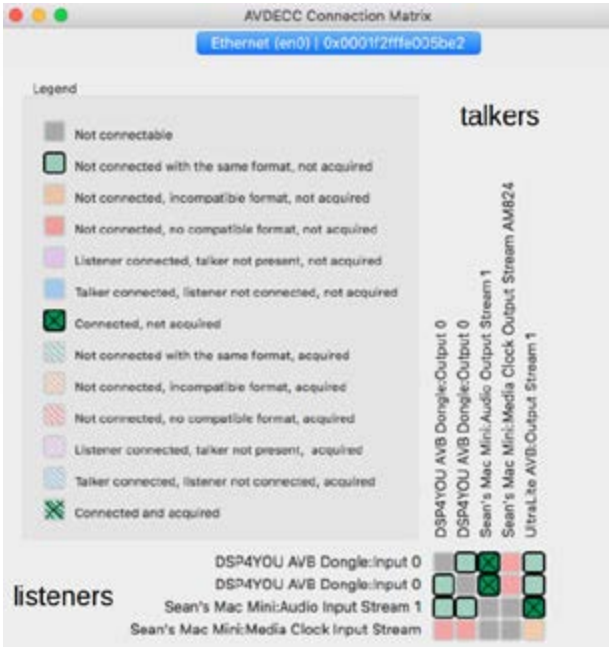


Fig. 2: *An AVB connection matrix which is natively implemente within an Apple Mac. Columns denote device talker outputs. Rows denote device listener inputs. Active connections are shown as dark green with an 'x'.*

ImmerGo

The ImmerGo system uses a client-server based approach to sound localisation which is different from plugin based approaches such as New Audio Technology's Spatial Audio Designer [6] and Facebook's Spatial Audio Workstation [7] [8]. Plugin based approaches restrict a user to the DAW streaming audio to one another. Here we have an Apple Mac virtual AVB entity acting as both a talker and listener. The other devices are specifically talkers or listeners. Their connections are listed below.

1. The Apple Mac's virtual AVB talker streams a single audio stream to 2 DSP4YOU network DACs.

2. The Ultralite AVB interface streams to the Apple Mac's virtual AVB listener.

workspace and require a plugin on each channel before being able to localize them.

The client-server approach allows for the spatial audio renderer and it's control to run in parallel with any multichannel audio software housed in the computer. This provides the ability to render the audio track positions in real-time without being restricted to the DAW [9]. Also particularly in ImmerGo's case it allows for the capability to distribute rendering processing to multiple processor end-points outside of the computer running the multichannel audio software. This client-server and distributed processing approach is well suited to spatial audio content creation and gives less restriction to the user in terms of what multichannel audio software they wish to use. For the purposes of this paper the Reaper DAW [10] will be considered as the multichannel audio software that houses the multiple audio channels that are to be localized.

ImmerGo provides the following functionality,

- Control over object based audio mixing.
- Distribution of processing load to multiple end-points.
- Management of AVB connections.
- Client control from a web browser.
- Control over DAW transport.

Object Based Audio In ImmerGo

Object based mixing has been designed specifically for spatial audio. Each audio track has associated with it metadata that is used by a spatial audio renderer to mix the audio appropriately to speaker outputs. Various parameters may be contained in the metadata that are used to describe the audio track's position, volume, distance and spread within the mix. This metadata is associated with timestamps that allow these parameters to change over time.

Object based audio mixing is distinguished from channel based audio mixing in that it abstracts the spatial information of audio tracks from the rendering stage. [15] Channel based mixes are created specifically for a determined speaker configuration when being mixed and result in a multichannel audio file where each channel pertains to a signal driving a speaker. These are generally mastered and compressed prior to playback on a specific speaker system (such as 5.1, 7.1, 11.1 etc). These mixes are only perceived correctly when played back on the speaker systems they were mixed for. Object based audio abstracts from the channel based approach as it ties positional metadata to audio tracks that can then be used by a renderer to calculate signals driving speakers at a later stage at playback. This offers more flexibility when creating spatial audio content as the positional information of track objects are recorded and can be then be used by a renderer that's designed for arbitrary speaker configurations.

A standardised object based audio specification was first introduced by the European Broadcasting Union (EBU) within their "TECH 3364" as an "Audio Definition Model - Metadata Specification" [11] and since then other proprietary versions have been developed and used by larger companies' technologies such as Dolby Atmos, DTS:X and Auro3D AuroMax [12] [13] [14].

The EBU specification provides the basis for the track object model metadata used by ImmerGo [16]. In this specification, audio tracks are referred to as unique objects within a 3D environment. Associated with these unique track objects are sound levels, locational coordinates as well as any other position specific information such as spread. This is coupled with the ability to timestamp the objects so these parameter changes may be recorded over time.

Object Based Audio Rendering In ImmerGo

Other object based audio control and rendering platforms such as the Jamoma package in MaxMSP [17] [18] offer similar capabilities to ImmerGo, however there is a noticeable processing ceiling when the speaker configuration becomes large. ImmerGo provides a novel approach within it's implementation since it distributes the rendering processing by leveraging Ethernet AVB networking and the AVDECC protocol.

One of the Ethernet AVB device types used with ImmerGo is the NDAC8, which is built by miniDSP [19]. NDAC8s contain XMOS processors [20] which have been modified to contain a mixing matrix that is controllable via AVDECC control messages sent from the ImmerGo server. This mixer matrix is shown in figure 3. It accepts 8 audio inputs from an AVB stream and performs an attenuation followed by summation mixing to 8 speaker outputs. This makes the system easily scalable as users of the system may incrementally add more processing power to their setups as they add NDAC8s and speakers and needn't purchase a full rig at once. The ImmerGo server is able to pick up added processors on the network automatically by using a speaker configuration file. This prevents the need to manually set up complex channel connections.

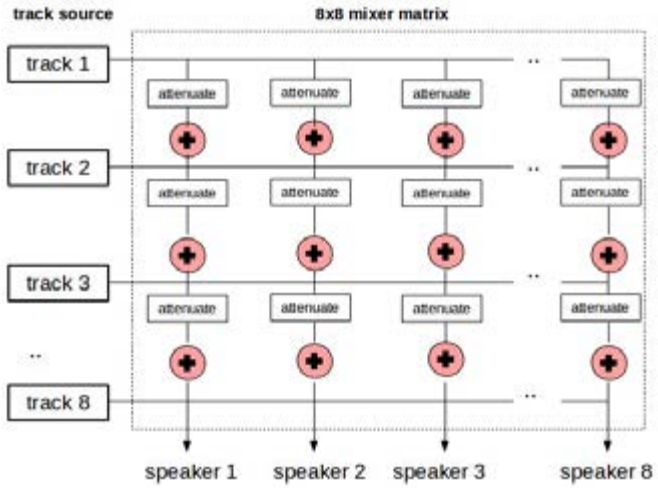


Fig. 3: *Mixer matrix within each NDAC8.*

This distributed approach splits rendering of spatial audio into two main processing components,

1. Calculating speaker mix levels for each audio track within the server.
2. Mixing audio track samples at end-point NDAC8 processors using commands from the server.

ImmerGo Configuration and Connection Management

Figure 4 shows a typical ImmerGo setup. The server has been built using nodeJS [21]. NodeJS provides necessary packages for all the interaction between the various processes in the ImmerGo system. The server is hosted on a single Apple Macintosh computer and is able to send AVDECC requests to devices on the AVB network using Apple's native AVB virtual entity, as well as communicate with a DAW via MIDI. The client is hosted on any device that has a web browser and can connect to the network that the server is on. The XML file in figure 5 contains information pertaining to each NDAC8's MAC address, the number of speakers for each NDAC8 and their physical positions in the room. Upon initialization, the server places the information in the XML file into program memory. This allows for AVDECC messages to be sent to each AVB-enabled device to control and provide AVB stream connection management between network devices and the Mac AVB virtual entity. The speaker positions are used by the server to calculate and send the appropriate track mix levels to each processor.

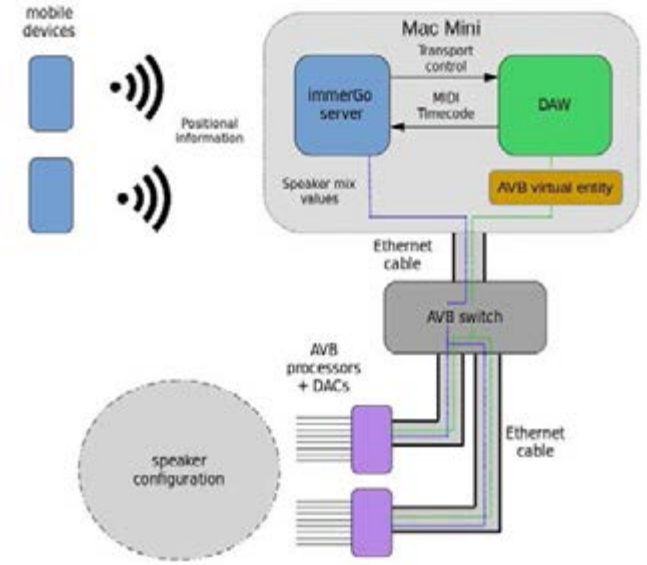


Fig. 4: *A typical ImmerGo setup.*

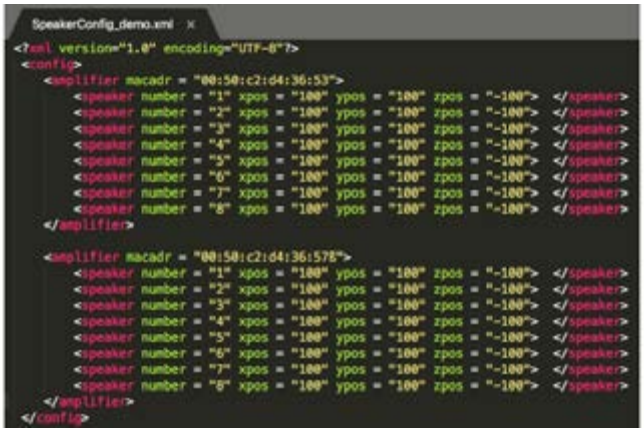


Fig. 5: *XML file containing relevant speakers for particular DACs on the network.*

ImmerGo uses AVDECC Connection Management messages [5] to manage all relevant device connections prior to streaming audio. This removes the need for the audio engineer to set them manually. The MAC addresses contained in the speaker configuration XML are used to send connection requests to each NDAC8 to connect streams from the Mac's AVB virtual entity talker to their listeners.

The server sends MIDI messages to the DAW via an internal MIDI driver to control DAW transport functions. Similarly, it also receives MIDI timecode (MTC) from the DAW which it uses to timestamp track location updates as well as ensure track location updates happen synchronously. This will be elaborated upon in the following section.

ImmerGo User Interface

The client GUI is served within a web browser which allows for a number of client devices to be used with ImmerGo. Figure 6 shows the UI that is served to the browser.

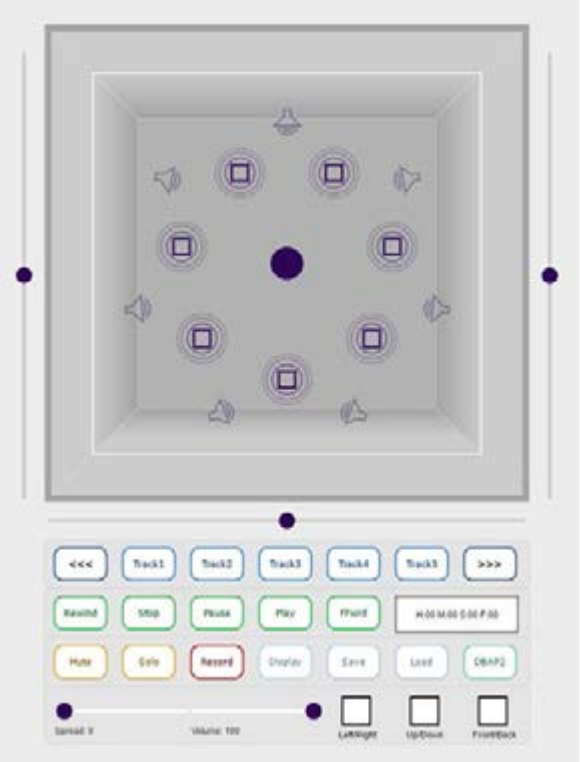


Fig. 6: *The immerGo UI*

The upper half of the interface is the track object control window. It shows the room with the physical speaker layout and walls surrounding the speakers. Speakers on the top of the room are shown differently from speakers on the side. Top speakers are darker and shown as squares with circles. The user may select tracks in the track selector bar just below the object control window and then use the purple dot or the vertical and horizontal sliders on the perimeter to position the audio object's height and horizontal x-y position in the room. The height of the source is given by the thin white line crossing the room walls. The user is also able to enable the gyroscope located in a mobile device using the check boxes. This allows for the control of a source's position using tilt, rotate and yaw gestures. The volume slider controls the loudness of the selected track and the spread slider controls the spread ratio of a source across the speaker array.

The mute and solo buttons are used to mute and solo particular tracks and the display button allows any recorded tracks to be displayed in the object control window.

In conjunction with spatial audio control, the client has controls for the basic transport control of a DAW and recording of track position given as the rewind, fast forward, pause, stop and play buttons. These controls use MIDI messages sent to the DAW which allows the control to be mapped to the corresponding DAW control using the MIDI bus. The timeline of the DAW is given in the box just next to transport controls and displays the MIDI timecode received from the DAW. The record button is used to record track position movements in real-time.

If automation is recorded, it is saved to a file that may be played back at a later stage. The buttons that do this are the save and load buttons. There is an algorithm selector button which allows for a user to select a particular rendering algorithm. These algorithms are explained in the next sub section.

ImmerGo Rendering Algorithms

ImmerGo's object based audio mixing approach provides the ability to interact with different rendering algorithms [1]. Each individual track's locational metadata is able to be fed into these various rendering algorithms which output mix levels required to render a track's position to the speaker array. Mix levels for each speaker pertaining to each track are then used for the mixing of audio.

Currently ImmerGo has implemented two different spatial audio rendering algorithms. Namely, vector-base amplitude panning (VBAP) [22] and distanced-based amplitude panning (DBAP) [23]. Both of these algorithms have the ability to create spatial audio content. However, there are particular limitations with both which make them better suited for different setups.

For any virtual source to be localized, vector-base amplitude panning determines the closest triplet of speakers to that source. This triplet forms a vector base where the listener is situated at the origin. These linear vectors are then used as gain values for each speaker to localize virtual sources within the triplet. This essentially means that there needs to be a locus, or 'sweet spot', where a listener may experience the spatial audio content around them. As a result of this, speakers need to be situated on the perimeter of a sphere and the listener needs to be located in the centre of the sphere and can only correctly perceive virtual source location when in the sweet spot.

DBAP [23] is formulated on the inverse square law of sound pressure attenuation over distance. This means it only takes distance of source to speakers as parameters and there is no locus, or 'sweet spot' considered. This makes it well suited to irregular speaker arrays where listeners are not restricted to one location but can move about.

Art installations generally require very irregular speaker setups due to them being housed in irregular venues. Speakers may need to be placed in positions that are not within a sphere. For the purposes of this paper, VBAP is not considered further because of the constraints that it's formulation imposes.

DBAP has the following features which make it well suited to installation art,

- Speaker gain values for tracks are calculated according to their distance from the virtual audio source, so no central sweet spot is specified.
- Virtual sources will still retain their perceived positional information no matter if speakers are added or removed.

Thanks to the formulation of this algorithm it is simple to scale the speaker configuration. As more speakers are added to the array, the normalization process of the algorithm will always account for any added speakers so the sound energy distribution remains constant. Arbitrary speaker arrays are well suited to the DBAP algorithm. [24]

Typical ImmerGo Workflow

This section describes a typical setup and workflow of ImmerGo. Here it is assumed an Apple Macintosh computer is used to host the server.

First the ImmerGo application is opened on the server and a speaker configuration XML is selected by the user. The server then determines the internal MIDI bus used for transport control and timeline display, the AVB network that the NDAC8s are attached to and the network that is used by the client. The server also connects a single 8 channel AVB audio stream from the Mac's virtual AVB entity to each NDAC8 that is specified in the speaker XML. Once the server is initialized a client device may type a URL, specified by the server application, in to a web browser. The client then receives the ImmerGo UI upon successful connection to the server. Here the user may now position track sources within the speaker array.

When positioning track sources the client sends the locational metadata to the server via a network socket. The server then uses this metadata to calculate each speaker's mix level pertaining to the track being positioned. Once the speaker mix levels have been calculated, they are encapsulated in an AVDECC control packet and sent via the AVB network to the appropriate NDAC8s at every quarter frame of MTC received from the DAW. Once the NDAC8s receive the mix levels, the channels of audio received from the AVB stream are mixed and sent to the appropriate speaker outputs.

Practical system configuration and implementation

This section describes the employment of ImmerGo and Ethernet AVB at a public performance held at an arts festival [25] [26]. The spatial audio rendering of the audio was controlled by the ImmerGo system in real-time. The speaker configuration consisted of 23 small full range speakers and 1 subwoofer which were hooked up to 3 NDAC8s. Figure 7 shows a diagram of the actual room layout of the installation with it's 3 main zones.

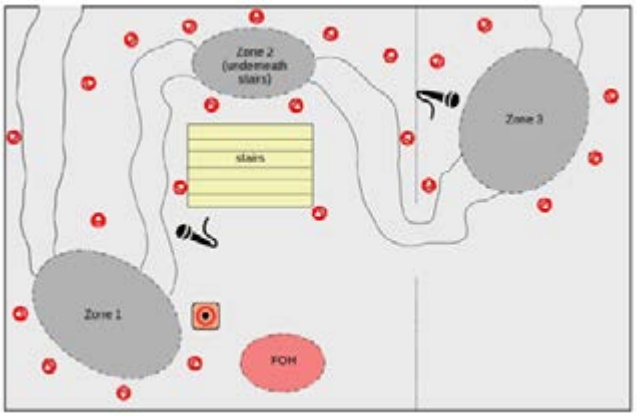


Fig. 7: *Layout of the installation showing speakers in red, sub woofer in orange and the microphone placement. The audience were required to move through the tunnel that connected the different zones.*

Installation Content

Figure 8 shows a picture of the installation space. The installation spanned two large rooms and consisted of a long tunnel made out of plastic milk bottles and various polyester packaging. The audience were asked to crawl through the tunnel. Actors were situated at each of the 3 zones and interacted with both the sounds and the audience. The sound score consisted of both static and dynamic sources. The static sources were field recordings of an electric substation, polluted river water and water swishing within milk bottles. These field recordings were situated at the 3 different zones. The dynamic sources were recorded foley sounds of plastic bottles being crunched up. The interactiveness of the installation was enhanced using live recordings of the audience in the tunnel that were played back on the speakers.

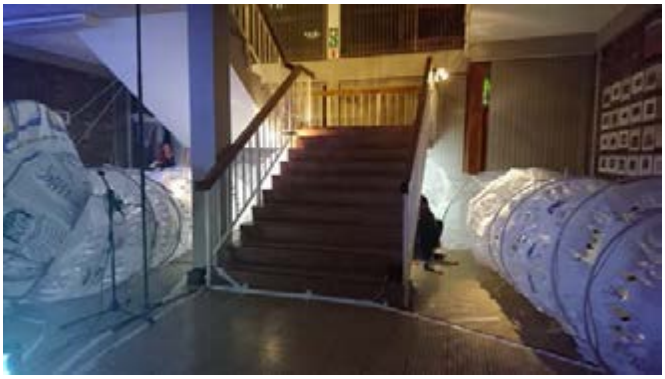
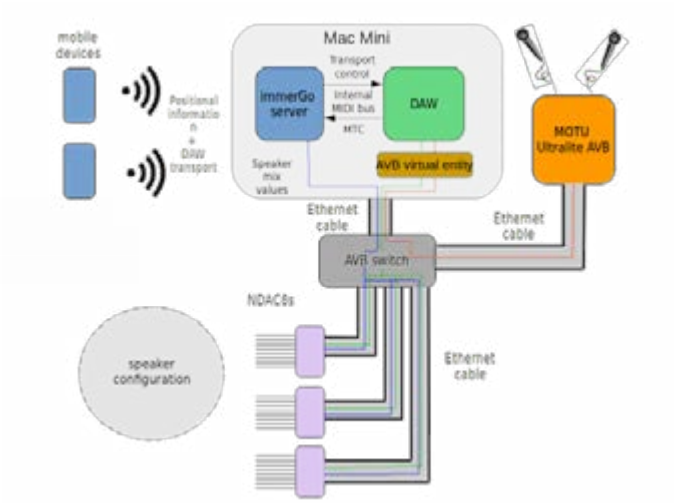


Fig. 8: *Main room for installation.*

capture and stream live feeds from two microphones placed in separate rooms. The NDAC8s were connected to two amplifiers which powered speakers located around the installation space. All of the AVB network devices were connected to a single MOTU 5 port AVB switch [28].



Technical Setup

Figure 9 shows a diagram of the system setup that was built for the installation. It contains multiple AVB enabled devices that stream audio to one another. The observed system configuration used an Apple Macintosh Mini to host the ImmerGo server and the Reaper DAW which held an ambient multitrack. A MOTU Ultralite AVB [27] interface was used to

Fig. 9: *System configuration used at installation.*

The process of operation was as follows. Firstly the system was set up prior to panning. The Mac's virtual entity was enabled with input and output streams set to carry 8 channels of audio each as shown in figure 10. The AVB connection matrix within the Mac then allowed for connections to be made using a connection matrix GUI as shown earlier in figure 2. A talker connection was made

from the Ultralite's AVB talker to the Mac's AVB virtual entity listener. From here, the ImmerGo server was initialized with the appropriate speaker configuration xml file. The server then automatically set up a talker stream from the AVB virtual entity talker to each NDAC8's listener.

The ImmerGo UI that held the speaker configuration is shown in figure 11. All speakers are shown as top speakers because the configuration was constrained to the x and y dimensions.

Fig. 10: *Mac AVB virtual entity setup.*

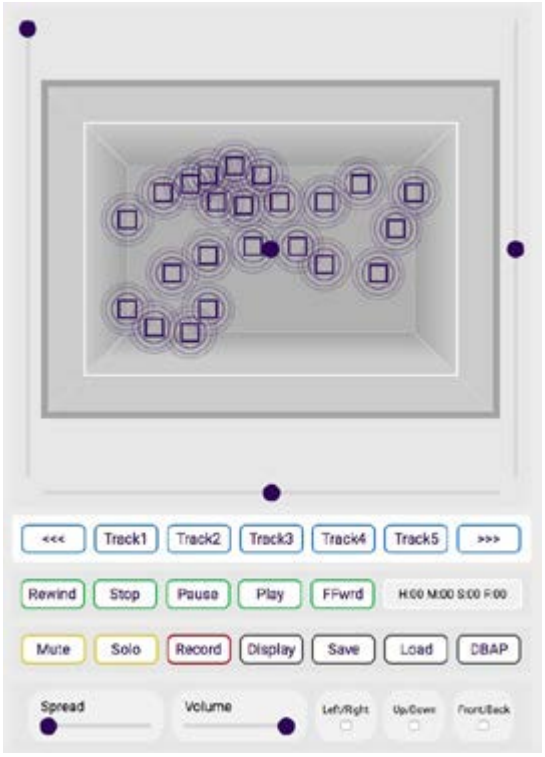


Fig. 11: *ImmerGo client GUI for installation.*

Once the server was up and connections made, the Reaper DAW was opened and the Ethernet AVB virtual entity set as the audio interface. Figure 12 shows the routing configuration setup within Reaper. 2 tracks for mic 1 and 2 were created and set to receive the live feed from the Ultralite via the Apple AVB virtual entity listener. The live feed tracks were set to monitor channels 1 and 2 of stream 1 and these monitor feeds were manipulated using Reaper's built-in track delays, slight pitch shifting and equalization to reduce room feedback and create an ambient effect. 6 other tracks were also created that held the pre-recorded ambient tracks. The 2 live monitor tracks along with the 6 pre-recorded track channels filled an 8 channel stream output. This stream was then sent to each NDAC8 via the AVB virtual entity talker. A single MTC track was created within the DAW which sent MTC to the server via the IAC internal MIDI bus on the Mac for any automation that needed to be recorded.

From here the audio was streamed to NDAC8s connected to the speakers in the separate rooms. The ImmerGo GUI was hosted on a mobile device which allowed the mix engineer to control the movement of the sources and DAW transport from anywhere in the room. The performance had a combination of static ambient sources and moving sources. Dynamic sources included pre-recorded tracks and the live track input feeds and were moved according to audience positions whilst the performance was running. This allowed for particular sounds to have an interactive feeling. Different effects such as reverb, delay and pitch shifting were applied within the DAW. These effects were treated as separate audio objects that were able to be positioned, which helped to compliment the immersive feel of each audio object.

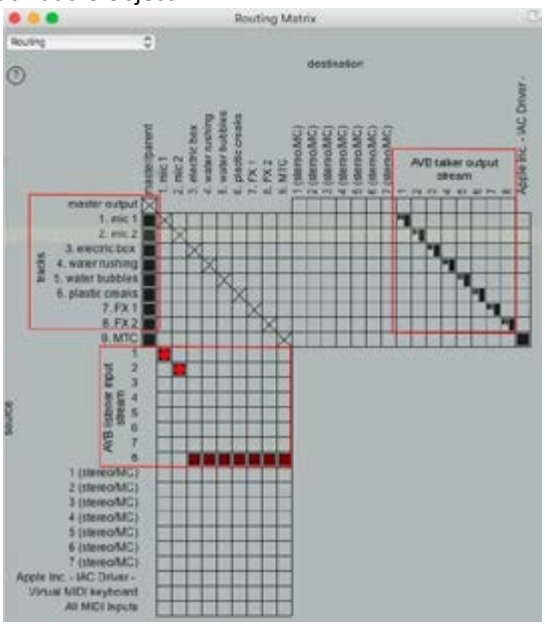


Fig. 12: *Routing matrix setup within Reaper. Here track connections are shown as blocks. Track outputs are the rows and*

are connected to driver outputs at columns. Track inputs are red connection blocks.

Conclusion

It has been shown that Ethernet AVB and ImmerGo offer a viable way to create real-time spatial audio content that meet the requirements of a choreographed art installation. The analysis of Ethernet AVB and ImmerGo's features provided a terminology with which to describe the installation's audio setup. Ethernet AVB in particular provided simple plug and play functionality to allow for multiple devices from different manufacturers to stream audio to one another with minimal latency and QoS. The AVB connection matrix allowed for a simple routing setup of audio channels to these devices.

Most notably, live audio feeds were able to be streamed to the DAW via AVB which allowed them to then be controlled by ImmerGo. The ImmerGo spatial audio system provided an intuitive way to manage stream connections from the DAW to NDAC8s as well as control the spatial audio mix using a mobile device. The use of a mobile device gave the engineer the freedom to move around the space as the performance was mixed.

References

[1] Richard Foss and Antoine Rouget. Immersive audio content creation using mobile devices and ethernet avb. In *Audio Engineering Society Convention 139*, Oct 2015. URL: http: //www.aes.org/e-lib/browse.cfm?elib=18009.

[2] J. Eveleens. Ethernet avb overview and status. *presented at SMPTE 2014*, October 2014.

[3] L.K. Joy. Ethernet avb for time-sensitive networks, August 29 2017. US Patent 9,749,147. URL: https://www.google.com/ patents/US9749147.

[4] Ieee std 1722 (ieee standard for a transport protocol for timesensitive applications in bridged local area networks).

[5] Ieee std 1722.1 (ieee standard for device discovery, connection management, and control protocol for ieee 1722 based devices).

[6] New Audio Technology. Spatial audio designer. URL: http://www.newaudiotechnology.com/en/products/ spatial-audio-designer/.

[7] Facebook. Spatial audio workstation. URL: https:// facebook360.fb.com/spatial-workstation/.

[8] R. Foss and A Rouget. Positioning an output element within a three-dimensional environment, October 20 2016. WO Patent App. PCT/IB2016/052,117. URL: http://www.google.gm/ patents/WO2016166687A1?cl=en.

[9] Gabriel Gatzsche and Christoph Sladeczek. A flexible system architecture for collaborative sound engineering in objectbased audio environments. In *Audio Engineering Society Convention 136*, Apr 2014. URL: http://www.aes.org/e-lib/ browse.cfm?elib=17228.

[10] Cockos. Reaper digital audio workstation. URL: https://www. reaper.fm/.

[11] European broadcasting union: Tech 3364 audio definition model metadata specification version 1.0. january 2014.

[12] Dolby. Atmos. URL: https://www.dolby.com/us/en/ technologies/home/dolby-atmos.html.

[13] DTS. Dts:x creator suite. URL: http://dts.com/shop/ dtsx-creator-suite.

[14] Auro Technologies. Auro3d. URL: https://www.auro-3d.com/ system/.

[15] Auro Technologies and Barco. Auromax.2015. URL: https://www.auro-3d.com/wp-content/uploads/documents/ AuroMax_White_Paper_24112015.pdf.

[16] Richard Foss and Antoine Rouget. Approaches to immersive audio content creation. *Tonmeistertagung - VDT International Convention*, 2016.

[17] P. Baltazar T. Place N. Wolek & J. Rabin T. Lossius, T. de la Hogue. Model-view-controller separation in max using jamoma. *Proceedings of the joint 40th International Computer Music Conference & 11th Sound and Music Computing Conference, Athens.*, 2014.

[18] Cycling' 74. Max/msp. URL: https://cycling74.com/products/ max/.

[19] miniDSP. Ndac8. URL: https://www.minidsp.com/products/ network-audio/n-dac8.

[20] XMOS. xcore multicore microcontroller. URL: http://www. xmos.com/products/silicon/xcore-200.

[21] Node.js. URL: https://nodejs.org/en/.

[22] Ville Pulkki. Virtual sound source positioning using vector base amplitude panning. *J. Audio Eng. Soc*, 45(6):456–466, 1997.

[23] Trond Lossius, Pascal Baltazar, and Théo de la Hogue. *DBAP–distance-based amplitude panning*. Ann Arbor, MI: Michigan Publishing, University of Michigan Library, 2009.

[24] Dimitar Kostadinov, Joshua D Reiss, and Valeri Mladenov. Evaluation of distance based amplitude panning for spatial audio. In *ICASSP*, pages 285–288, 2010.

[25] Lexi Meier. Down to a sunless sea at south african national arts festival 2017. 2017. URL: https://leximeierchoreography. wordpress.com/2017/07/27/down-to-a-sunless-sea/.

[26] National arts festival. 2017. URL: https://www. nationalartsfestival.co.za/.

[27] MOTU. Ultralite avb. URL: http://motu.com/products/avb/ultralite-avb.

[28] MOTU. Avb switch. URL: http://motu.com/products/avb/avb-switch.

Will Machinic Art Lay Beyond Our Ability to Understand It?

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Abstract

In this paper we will argue that artistic creations made by artificial minds will most likely lay beyond our ability to understand them. We will assume that the emergence of consciousness in artificial minds is possible and that the artistic creations we are referring to are made by the artificial minds' own volition. We will build upon the definition of art as embodied meaning and explore its relationship with embodied cognition to argue that there is a binding of human artistic creation to the subjective experience of existing in a natural and cultural world through a human body that is born with a foretold death. Additionally, we will try to show that the best we can aim at, as human beings standing by an artistic creation by another species, is to an understanding of what could have motivated another human being to create such a work. As such, we shouldn't be able to understand an artistic creation originating by an artificial mind with a physical experience of the world that differs from our own, even if they have a privileged access to our culture. The boundaries for this incomprehension are those of the human mind.

Keywords

Machinic Art, Artificial Creativity, Artificial Intelligence, Consciousness, Aesthetics, Artificial Aesthetics, Definition of Art, Embodied Meaning, Embodied Cognition, Anthropomorphism.

Introduction: Four Assumptions

Our aim with this paper is to discuss artistic creation by artificial minds. We will question how it is that we, human beings endowed with natural minds, may or may not be able to understand, enjoy, empathise with, or even recognise machinic creations as art.

In order to develop this argument, we will make four assumptions:

First assumption: Sometime in the future artificial minds with at least human-level artificial intelligence will be developed (Tegmark 2017).

Second assumption: Consciousness is an emergent property (Gazzaniga 2011), it is substrate-independent and not contingent on any properties of human wetware (Hofstadter 2007).

Third assumption: The emergence of consciousness in artificial minds is possible, maybe even inevitable. We are very aware of the intense, long-standing, and continuing debate surrounding these questions, both in the fields of artificial intelligence and cognitive sciences (e.g., Turing 1950; Turing 1951; Bateson 1979; Pinker 1999; Eagleman 2011; DiSalvo 2011; Humphrey 2011; Oliveira 2017; Damásio 2017), as well as in philosophy (e.g., Jefferson 1949; Anderson 1964; Searle 1981; Penrose 1989; De Landa 1991; Dennett 1991; Bostrom, 2014) and in artistic and creativity studies (e.g., Boden 2004; Cope 2005; Hayles 2005; Ariza 2009; Deutsch 2011). In fact, even amongst the authors of this paper, the discussion is far from settled, but this fact is, as are these discussions, somewhat irrelevant to the arguments being proposed.[1]

We will argue that consciousness-endowed artificial minds will significantly differ from human minds or other organic and biologically evolved minds. And that therefore, their conscious experiences—because they are embodied (Metzinger 2009, 18-19)—will likewise be significantly different.

> The most important thing to know about thinking machines is that they will think different. (Kelly 2016)

Fourth assumption: Because we are discussing artificial intelligences that are at least human-level, that are endowed with consciousness, and therefore with comparable autonomy and agency, we will assume that these minds may also feel the need to engage in artistic activities.

When discussing machinic art, or machinic creation, we will not be referring to processes that are started by humans, where machinic systems are used by human artists and eventually endowed with varying degrees of autonomy in the development artworks (Galanter 2006). We will not be discussing anthropocentric procedural, algorithmic, or computational art, or what we may call *generative* art or interactive art (Carvalhais 2016). In short, we will not be discussing art produced *by* humans or *for* humans. We will be discussing the possibility of posthuman art (Bogost 2012). We will do this by focusing on the possibility of

[1] If any scepticism regarding human-level or above artificial intelligence, artificial creativity, or artificial consciousness does not allow one to fully follow this paper's arguments, please try to replace all occurrences of *artificial intelligence* by *alien intelligence*. Imagine replacing the idea of a created computational intelligence by the idea of an evolved organic intelligence that is nevertheless fundamentally different from humans or any earth-evolved intelligence. Keep in mind how Nicholas Rescher argued that alien life forms are perhaps "so alien that their science and technology is incomprehensible to us; we could never understand it as intelligence." (in Bogost 2012)

artistic creations developed by artificial minds and by those artificial minds' own volition. Naturally, from a human point of view these will be procedural, algorithmic, and computational, because they will be developed by computational systems. They will be generative, because the systems will be fully autonomous from any human artist. And they may be interactive, regardless of whether the interactions to be developed involve humans or other self-aware systems. They will not, however, be a result of a human deferring some—or even most—of the decisions to a machine, but the sole result of machinic intentions and decisions.

The problem of defining art

Dwelling upon the problem of defining *what art is* reveals a long list of putative definitions and an even longer list of rebuttals. From the representation theories of art[2]

> x represents y (where y ranges over a domain comprised of objects, persons, events and actions) if and only if (1) a sender intends x (e.g., a picture) to stand for y (e.g., a haystack) and (2) the audience realizes that x is intended to stand for y. (Carroll 1999, 25)

to the emergence of aesthetics as a discipline from the eighteen-century onwards

> x is an artwork if and only if (1) x is produced with the intention that it possess a certain capacity, namely (2) the capacity of affording aesthetic experience. (Carroll 1999, 162)

including expressionist theories of art

> x is a work of art if and only if x is (1) an intended (2) transmission to an audience (3) of the self-same (type-identical) (4) individualized (5) feeling state (emotion) (6) that the artist experienced (himself/herself) (7) and clarified (8) by means of lines, shapes, colors, sounds, actions and/or words. (Carroll 1999, 65)

and formalist theories of art

> x is a work of art if and only if x is designed primarily in order to possess and to exhibit significant form. (Carroll 1999, 115)

Each of these and other formulations of related theories were presented at one point as very promising definitions, but they all fell under the weight of art's capacity to reinvent itself. They all seem to agree, however, in proposing the existence of an intention that a creator somehow manifests through a work of art—the x—to a given audience that has some ability to understand it. It is often difficult to grasp, however, what makes this x—i.e., the object, action or proposal *in itself*—entitled to the special status of being considered *a work of art* if we ignore the context of its creation and presentation. Andy Warhol's *Brillo Box (Soap Pads)* (1964) is a classic example of an artwork whose physical manifestation has negligible objective differences that we can use to differentiate it from the mundane object it was inspired on. Arthur C. Danto uses this example extensively when defining his concepts of *artworld*

> To see something as art requires something the eye cannot decry—an atmosphere of artistic theory, a knowledge of the history of art: an artworld. (Danto 1964, 580)

and of works of art as *embodied meanings*

> The artwork is a material object, some of whose properties belong to the meaning, and some of which do not. What the viewer must do is interpret the meaning-bearing properties in such a way as to grasp the intended meaning they embody. (Danto 2013, 38)

But what is this artworld that we must know before seeing something as art? How does the audience know they should strive to interpret meaning in a material object? These and other questions led George Dickie (1969) to expand on Danto's concept of the artworld and to propose an institutional theory of art that states that

> x is an artwork in the classificatory sense if and only if (1) x is an artifact (2) upon which someone acting on behalf of a certain institution (the artworld) confers the status of being a candidate for appreciation. (Carroll 1999, 227)

This theory became very successful by refocusing the attention away from the artefact and towards the sociocultural context of its presentation. It does not, however, provide any criteria to this status of being a candidate for appreciation. In the case of a given machinic artefact, the mere recognition of it as art by any agent or institution of the artworld would instantly make it art and the reasons presented for that recognition—whichever they would be—would become a way to understand the work: problem solved. The theory is unable to help us in excluding the possibility of misunderstanding the proposal or even the likelihood of considering as a candidate for appreciation something that the machine did not intend as such.

Jerrold Levinson (1979) took the institutional theory of art as an inspiration, but aimed to develop a new theory that was more focused on the intentions of the individual who created or presented the artefact or action. The historical definition of art thus states that

> x is an artwork if and only if x is an object of which it is true that some person or persons (1) who have a proprie-

[2] For exemplar formulations of the different theories of art, and for the sake of consistency and comparability, we will use those proposed by Nöel Carroll (1999).

> tary right over x (2) nonpassingly intend (or intended) x for regard-as-a-work-of-art—i.e., for regard in any way (or ways) in which objects already in the extension of "artwork" are or were correctly or standardly regarded. (Carroll 1999, 243)

This theory might be viewed as entailing an anthropocentric view of art, since it presupposes that the artefact, action, or proposal was conceived to be regarded in a way similar to those of previous—and strictly human-conceived—artistic proposals. But, in fact, it has an elegant way of integrating the idea that art is an open, evolving concept that we can disentangle by looking for Wittgensteinian family resemblances. Also, it captures the intention of the creator that was present in previous theories but absent from the institutional theory of art. Let us assume that we somehow know that our machine has the explicit intention of creating something to be regarded as an artwork.[3] How would we try to understand it? What do we do when we regard something as art? What do we do when we regard something as not-art?

One thing seems to be certain: regarding something as art or as not-art is usually not a mere classification, but most of the times an evaluation (i.e., a judgement of value). And this evaluation comes from the experience we have of that artwork (Dewey 1934), from the relation we establish and the meaning we extract from it: we do not merely *see/hear/touch/etc*. art, but we *understand/feel* art.

As we saw, in most definitions of art we have, even if solely implied, a creator with intent and an audience capable of understanding meaning or significance. This relation is mediated by an artwork, but whilst this artwork somehow carries meaning or significance, those are not intrinsic to it, i.e., they do not constitute *objective* characteristics. Any artwork would simply cease to *be* an artwork without the existence of subjects capable of understanding and valuing it as such. Just as a gesture is never merely a physical movement, but it always conveys—or bears, as implied by its etymology—an intention from one agent to another. Stripped of this embedded meaning, a gesture can be objectively described as a movement, but in doing so we miss all of its intent, purpose and usefulness.[4]

This meaning, however, is usually not explicit. The artwork does not describe or define meaning as, e.g. a mathematical expression would. Just as with a gesture, the understanding of meaning can be altered by our attention, simultaneous stimuli, momentary feelings or our comprehension of the context. Our perception of emotion in music, e.g., has been shown to be greatly dependent on cross-modal interactions and to even be highly susceptible to knowledge about the authors' emotional context when writing it (Margulis, 2017). If we were aiming to approach music *objectively*, then this instability of reception could be regarded as yet another proof of how unreliable and biased our perception and cognition are. But it does not make sense to approach art *objectively*. The fruition of art is always about the *subjective* experience of the artwork and anything that contributes to enrich our experience of an artwork is not an obstacle, but a catalyser. And we all share a long history of suspending our disbeliefs for the sake of our experiences of art. Furthermore, this suspension of disbelief—or even the creation of new beliefs (Gottschall 2012; Zacks 2015)—is often surprisingly effortless, and meaning spontaneously emerges in our minds as more than the sum of its explicit parts, just as when we understand a beautiful gesture or a compelling metaphor. Anything that brings us closer to the ability to understand intentions behind an artwork, a gesture or a metaphor—even if based on fictitious cues, as long as we do not know or do not actively choose to focus on the fact that they are false (Zacks 2015)—deepens our experience. But how can art do this to us? And how can we approach art in a meaningful way despite this apparent volatility?

Approaching art subjectively

We propose that the main strategy we use when trying to understand an artistic proposal is the subjective inference of the *subjective choices* made by its author. *Choices* because we assume that the artist had various options and freely selected the ones they presented. *Subjective*, on one hand, because we always assume the existence of a subject that made the choices: the author might be dead (in the Barthesian sense) or unknown—or we might misinterpret them entirely—, but we always infer their existence. *Subjective*, on the other hand, because we tend to conjecture *intentions* behind the choices. In this sense, the appreciation of art is very close to the moral appreciation of other people's actions and gestures: both assume the existence of an uncoerced choice and both are based on the reading of intentionality behind actions. As we don't have direct access to other minds, we are constricted to a second or third person view over their behaviours as our gateway to know their intentions. Yet we seem somehow able to avoid the reductive aspects of behaviourism.

We do that by reading behaviours alien to us with the superposition of our own experiences and feelings in order to build a plausible model of the intentions behind them. Artworks, in the sense that we take them to be the outcome of subjective choices, are thus interpreted as direct or indirect results of the behaviours of other human beings. In the deciphering of these artworks, as in moral discernment and gesture interpretation, we make extensive use of an astonishing human skill: *empathy*, i.e., the capability of putting ourselves in the other's shoes, of thinking "what would I do/feel/think if was seeing/experiencing/acting on the world from that perspective". For that, we make extensive use of our imagination and, according to recent proposals

[3] We should bear in mind, however, that it would be perfectly acceptable for our machine to conceive a completely new and unwarranted meaning to the word *art* before producing artworks: our problem would just be a lot bigger.

[4] For a good example of the problems raised by an objective approach to art, see Danto's take on the restoration of the Sistine Chapel (2013).

in neuroscience, a particular kind of neurones that fire both when we act and when we observe the same action performed by others: the mirror neurones or, as V.S. Ramachandran puts it, *"the neurons that shaped civilisation"* (2011, 117). Contrary to what can be suggested by the word *mirror*, however, the purpose of these neurones is not merely to mimic other peoples' actions. Instead, their behaviour is influenced by our predictions of what is likely to happen, according to the inferred intentions of others, and fire differently according to that interpretation:

> If mirror neurons do, in fact, signal intentions, how do they do it? One possibility is that the response of these neurons is determined by the chain of motor activities that could be expected to happen in a particular context […]. For example, when a person picks up a cup with the intention of drinking, the next expected actions would be to bring the cup to the mouth and then to drink some coffee. However, if the intention is to clean up, the expected action might be to carry the cup over to the sink. According to this idea, mirror neurons that respond to different intentions are responding to the action that is happening plus the sequence of actions that is most likely to follow, given the context. (Goldstein 2013, 168)

Being associated with actions, mirror neurones are highly related to our internal mapping of our own body and we use this somatic resonance extensively, along with our experience of the limits of our own body and of the forces exerted over it by the environment, when appreciating art. We can feel weightless when watching Nureyev, overwhelmed by the physical effort of Martha Argerich playing Liszt's *B minor sonata* or inhumanely balanced when staring at *The Dancing Shiva.*

> One day around the turn of the twentieth century, an elderly firangi ("foreigner" or "white" in Hindi) gentleman was observed gazing at the Nataraja in awe. To the amazement of the museum guards and patrons, he went into a sort of trance and proceeded to mimic the dance postures. A crowd gathered around, but the gentleman seemed oblivious until the curator finally showed up to see what was going on. He almost had the poor man arrested until he realized the European was none other than the world-famous sculptor Auguste Rodin. Rodin was moved to tears by The Dancing Shiva. In his writings he referred to it as one of the greatest works of art ever created by the human mind. (Ramachandran 2011, 238)

Not all art is, however, as directly relatable to the human body as the traditional performing arts. Nonetheless, reading a purpose behind actions depends on our ability to understand or imagine the possible motives other human beings had to act the way they did and we inevitably bring our own experiences, our own body, and our own culture to the table when judging an intention. We can find some object beautiful or interesting, but we call it art solely if we can infer that someone had the intention of making it—or presenting it—as art. That is why we tend to be particularly careful in the way we experience something we find displayed at a museum, trying hard to unlock an intention behind it. In an example that travelled the world in May 2016, two students visiting the San Francisco Museum of Modern Art left a pair of "glasses on the floor below an official-looking piece of paper to see how it would be received by gallery-goers." (Hunt 2016) Pictures of people admiring and photographing this "artwork" travelled the world, through both social and conventional media, in most cases framed as evidence of just how gullible gallery-goers are or as how meaningless and decadent art has become. But it could just as easily be seen as evidence of how much art—in the classificatory sense—has the power to make us question and seek for an understanding of intentionality behind—or meaning embedded in—any object, action or proposal.[5]

Sometimes we can't understand a valid intention for presenting it as art, as sometimes we can't understand why that other person cut us off in traffic: in both cases, aesthetic and moral, we can easily feel angry or defrauded. And it seems clear that the closer our own experience is to the experience of a given artist, the easier it will be for us to understand (i.e., relate to their choices) and judge (i.e., conjure other possibilities and judge them against their choices) their proposal. The fact that it makes no sense to judge, e.g., John Cage's *Imaginary Landscape No. 4* (1952) for the content of a random radio program that happens to be heard during a given performance is only obvious to someone who understands where to find the subjective choices of the composer, despite the fact that its appearance is a direct consequence of these choices. But for those of us who understand that fact—either because we read it on the program notes or because we can interpret the cues from the context—, it becomes very clear that different performances of this piece, despite their superficial differences, are merely instantiations of the same piece. And we are capable of understanding that fact precisely because of our knowledge of where to find the subjective choices of the author—i.e., the things that don't change from one instantiation to another, the choices that govern the unpredictable elements. That is also the reason why all of the outcomes of a generative artwork governed by unaltered human-chosen algorithms, pseudo-random sources, or fitness functions should be regarded as different instantiations of the same artwork. If the subjective choices are the same, the artwork *is* the same, regardless of the range of different results that may emerge from the same process. For an artwork to be attributed to a machine, it *has* to be—even if only partially—the result of subjective choices made *by that particular machine*. As a human creator, that machine has to *be* a subject, it has to have intentions and it has to be able to make uncoerced choices

[5] The fact that we sometimes feel compelled to avoid expressing our honest opinions about artworks is an unrelated—albeit interesting—matter.

in order to make art. It has to have a first-person perspective, i.e., it has to be sensible to ask "What is it like to be that machine?". And in order to understand an artwork made by that machine, we must be able to understand its subjective choices. For that, we need to be able to empathise with the machine, we need to be able to provide some satisfactory answer to the aforementioned question.

The problem is that we have trouble empathising with agents that we cannot relate to, with subjective experiences and actions that we have trouble understanding, perhaps the ones our neurones have more trouble mirroring. As Thomas Nagel puts it, when referring to our ability to know what is it like to be a bat:

> Our own experience provides the basic material for our imagination, whose range is therefore limited. It will not help to try to imagine that one has webbing on one's arms, which enables one to fly around at dusk and dawn catching insects in one's mouth; that one has very poor vision, and perceives the surrounding world by a system of reflected high-frequency sound signals; and that one spends the day hanging upside down by one's feet in an attic. In so far as I can imagine this (which is not very far), it tells me only what it would be like for me to behave as a bat behaves. But this is not the question. I want to know what it is like for a bat to be a bat. Yet if I try to imagine this, I am restricted to the resources of my own mind, and those resources are inadequate to the task. I cannot perform it either by imagining additions to my present experience, or by imagining segments gradually subtracted from it, or by imagining some combination of additions, subtractions, and modifications. (Nagel 1974, 439)

We can empathise with non-human characters in human-made art *precisely* because they were conceived from the only subjective perspective that is accessible to us: as "what is it like for a human to behave as x". In a word, they were anthropomorphised:

> The risk of falling into anthropocentrism is strong. Indeed, I'll take things farther: anthropocentrism is unavoidable, at least for us humans. The same is true of any unit (for the bats, chiropteracentrism is the problem). The subjective nature of experience makes the unit operation of one of its perceptions amount always to a caricature in which the one is drawn in the distorted impression of the other. This is true not only of the encounter itself but also of any account of the encounter, which only further distances the one from the other by virtue of the introduction of additional layers of mediation. (Bogost 2012, 64-5)

Cultural differences between humans alone can account for severe difficulties in the development of empathy and in understanding artistic manifestations, as the history of European colonialism easily shows. The perimeter of our own particular experience of the world can also impose limits to our personal understanding of art: if, e.g., the only way I can envision myself exhibiting a given artistic proposal is by despising and deliberately trying to make fun of the audience, I will likely get offended by that proposal. It is as if any work of art could "be understood only by someone who has himself already had the thoughts that are expressed in it—or at least similar thoughts." (Wittgenstein 2001, 3).[6] And yet we seem to set no boundaries to our eagerness to read anthropomorphised creative intentions everywhere. Marvelling at the diversity and sublime might of Nature whilst reading plausible intentions of a human-like (albeit infinitely more powerful) designer, e.g., might explain our collective drive to believe in the actions of divine creatures. In the words of Ramachandran:

> But we are so deeply hardwired for imputing things such as motive, intent, and culpability to the actions of others that we often overextend our social emotions to nonhuman, nonsocial objects, or situations. You can get "angry" with the tree branch that fell on you, or even with the freeways or the stock market. It is worth noting that this is one of the major roots of religion: We tend to imbue nature itself with human-like motives, desire, and will, and hence we feel compelled to sup plicate, pray to, bargain with, and look for reasons why God or karma or what have you has seen fit to punish us (individually or collectively) with natural disasters or other hardships. This persistent drive reveals just how much the self needs to feel part of a social environment that it can interact with and understand on its own terms. (Ramachandran 2011, 252)

Popular culture, e.g., has several reports of "a few animals [that] are prodigious producers of 'art'" (Goldman 2014). Of these, a small Japanese pufferfish that builds intricate circular-shaped sand structures on the seabed has been called by David Attenborough "nature's greatest artist" (2014). It is actually quite astonishing how such a small fish can build such beautiful large structures, even using shells to decorate some of its elements. Except that it is not decoration or an aimless subjective manifestation, but a strategy to attract the female pufferfish. Something that has, since Darwin, served as an implausible explanation for the prevalence of art in human cultures. The male pufferfish, once that goal is fulfilled, pays no further attention to the structure, which defies our own expectations of an artistic motivation. Even in a scientific report published by *Nature*, we can find scientists writing things such as "strangely enough, the males never reuse the nest" (Kawase, Okata & Ito 2013). But why is it strange? Because we expect a human artist to see their creations as ends and not as means?

If animals did produce art, that art would be a manifestation of their subjective choices. There is, to the best of our

[6] Wittgenstein refers to the contents of his *Tractatus Logico-Philosophicus*, that he introduces with this sentence, not to any work of art.

knowledge, no evidence that any animal does that. That does not mean that they do not produce art, it only means that we are unaware of that endeavour. As Ludwig Wittgenstein puts it, "if a lion could talk, we could not understand him" (2009, 235). Similarly, if a lion produced art, we could not understand it. Instead, what we find is evidence that we attribute anthropomorphised intentions to the animals that produce objects that we find aesthetically pleasant: i.e., we ask "what could motivate a fellow human to make those aesthetic choices?" when regarding some animal-built artefact or structure. We usually remain oblivious to the fact that the animals that produce human-comparable "artworks", such as paintings, often have no choice at all:

> Our results suggest that painting does not improve the welfare of elephants and that its main benefit is the aesthetic appeal of these paintings to the public and their subsequent sale of which a percentage of funds might be donated toward conservation of the species. (English, Kaplan & Rogers 2014, 14)

We make sense of the world solely from our own perspective—however wide that perspective may be—, and art is no exception to that. Given this track record of misunderstandings, we believe it is very unlikely that we will ever be able to understand machinic art in any meaningful way, i.e., in a way that is plausible from the perspective of the machine.

An example: what is it like *to see*?

If we are able to see, we simply cannot understand what it is like to be born blind, what is it like to experience the world with eyes embedded in a different part of our body (such as our legs), or what is it like to see a different part of the electromagnetic spectrum. For us, *to see* is always a shortening of *to see like me*. And we often take *computer vision* as a shortening of *making a computer see like me.* This is, as we know, far more difficult than some recent breakthroughs might suggest at first sight. Understanding machinic visual art, on the other hand, would require us to *see like a computer.* This, however, is not as simple as looking at a picture or video taken by a webcam.

Bertrand Russell, in the introduction to his *The Problems of Philosophy,* makes a distinction between the view of the practical man and the philosopher, on one hand, and that of the painter:

> […] the painter has to unlearn the habit of thinking that things seem to have the colour which common sense says they 'really' have, and to learn the habit of seeing things as they appear. Here we have already the beginning of one of the distinctions that cause most trouble in philosophy—the distinction between 'appearance' and 'reality', between what things seem to be and what they are. The painter wants to know what things seem to be, the practical man and the philosopher want to know what they are; but the philosopher's wish to know this is stronger than the practical man's, and is more troubled by knowledge as to the difficulties of answering the question. (Russell 2001, 2)

This is reminiscent of the Lockean distinction between primary qualities—properties which an object possesses independent of the subject—and secondary qualities—caused by the interaction of a subjects' perception with the primary qualities of an object (Uzgalis 2017). If we want to know how things *really* are, we know that we should strive to get as close as possible to the former. But art, as Russell points out, is not about how things *really* are, but instead about how we *experience* things. If anything, Russell's description is incomplete: the painter wants to know what things seem to be *from their perspective*, i.e., as they themselves experience it. It is not the case that the painters are not concerned with the reality—often reduced to the reality of how things *really are*—, they simply are focused on the reality of how things *appear to them*. As Nagel puts it:

> Very little work has been done on the basic question (from which mention of the brain can be entirely omitted) whether any sense can be made of experiences' having an objective character at all. Does it make sense, in other words, to ask what my experiences are really like, as opposed to how they appear to me? We cannot genuinely understand the hypothesis that their nature is captured in a physical description unless we understand the more fundamental idea that they have an objective nature (or that objective processes can have a subjective nature). (Nagel 1974, 448)

Learning this, Russell's painter can then proceed to manifest, both consciously and unconsciously, their vision of how things appear to them in a holistic way: including their qualia, their underlying emotions and feelings, their views over their motifs, their sense of structure, their painting techniques, the spirit of their epoch, etc. Representational art might favour the manifestation of qualia, expressionist art might prefer to reinforce emotions, formalist art might focus on the appreciation of structure, but they all manifest a holistic subjective view of the painter to a given audience. Perspective, as John Berger puts it, is a very good example of this:

> The convention of perspective, which is unique to European art and which was first established in the early Renaissance, centres everything on the eye of the beholder. It is like a beam from a lighthouse—only instead of light travelling outwards, appearances travel in. The conventions called those appearances reality. Perspective makes the single eye the centre of the visible world. Everything converges on to the eye as to the vanishing point of infinity. (Berger 1972, 16)

The invention of photography in the 19th century, with its more *objective* view over the visual world, changed

things dramatically. Nonetheless, photography had to struggle for its status as an artistic medium, precisely because it was for a long time unclear how it could be used to manifest a subjective perspective.

> The camera isolated momentary appearances and in so doing destroyed the idea that images were timeless. Or, to put it in another way, the camera showed that the notion of time passing was inseparable from the experience of the visual (except in paintings). What you saw depended upon where you were and when. What you saw was relative to your position in time and space. […] Every drawing or painting that used perspective proposed to the spectator that he was the unique centre of the world. The camera—and more particularly the movie camera—demonstrated that there was no centre. (Berger 1972, 18)

This contradicts the common-sense idea that painting evolved to slowly approach the "realism" of photography. In fact, and from an artistic perspective, it is easy to see that the exact opposite is actually closer to the truth. Whilst the invention of photography had a significant impact on the subsequent evolution of painting, that movement was not towards the realism of the more objective view we suddenly had easier access to, but actually away from it and towards a greater "subjective realism". Photography still had to evolve, as a medium, to approach the way painting could already be used to convey a first-person perspective over something, the way that painting embodied subjective choices, the way that painting approached three-dimensionality, the way that painting approached the time from the perspective of consciousness, as opposed to the time interval determined by the exposure of film. As Danto puts it:

> With a film speed of ASA 160 and shutter speeds of one-sixtieth of a second we could now capture the face appearing in ways which the eye never sees—'between expressions,' as it were. That is why we reject as not 'really me' many of the images on a contact sheet, which don't look like what we see in the mirror… The still shows 'optical truth' but it does not correspond to perceptual truth, namely how we see the world stereoptically. (Danto 2013, 106)

We would hardly call art to a painting that aimed towards an *optical truth*, except perhaps in the common-sense idea that art can be synonymous with a highly developed skill. We had to wait until photographers learned how to manifest their subjective choices through the use of the camera and until audiences learned how to empathise with the human behind the lens to understand photography as an art form. What if behind the camera—or the webcam—is not a human, but a machine capable of making subjective choices? Will we ever learn how to empathise with the subjective views of a being that has such a radically different experience of the world?

Conclusion

The problem is not whether machines will or will not develop a sense of self that leads to an eagerness to manifest their own subjective experiences of the world. The problem is that if—or *when*—they do, they will have such a different experience of the world that we will likely be completely unable to relate to it from our subjective perspective. Our subjective human experience stems, amongst many other things, from being born and slowly educated within a society of fellow human beings, from fighting the inevitability of our own death, from saving memories based on our own insubordinate feelings, from the lonely curiosity of our own mind, from the omnipresence of the needs and quirks of our biological body and from the way it dictates the space and time scales we can grasp.

It may very well happen that we understand some actions or artefacts created by machines of their own volition as art, but in doing so we would most likely be anthropomorphising the machine's intentions and thus missing out on their machinic perspective. Whilst we can have interpretations of a human-made artwork that differ from those of the author—art does not describe with observer-independent purposes—, these interpretations infer a human author and, if well-informed, can be reasonable even for the original author. With a non-human author—and assuming we get to the point of correctly identifying the artefact as an artistic manifestation—, our anthropomorphised interpretation will likely seem implausibly alien for a machinic perspective.

On the other hand, we may of course envision building a biological machine that would be born and afraid of dying just like us, a machine that would be emphatic and social just like us, that would have a body, sensorial apparatus, and mirror neurones just like our own. In face of that machine, we would certainly be much more likely to understand their actions or artefacts as art. But maybe we should more accurately call that machine a *human being*.

Acknowledgements

FourEyes is a Research Line within project "TEC4Growth – Pervasive Intelligence, Enhancers and Proofs of Concept with Industrial Impact/NORTE-01-0145-FEDER-000020" financed by the North Portugal Regional Operational Programme (NORTE 2020), under the PORTUGAL 2020 Partnership Agreement, and through the European Regional Development Fund (ERDF).

References

Anderson, Alan R., ed. *Minds and Machines*. Englewood Cliffs, NJ: Prentice-Hall, 1964.

Ariza, C. (2009). The Interrogator as Critic: The Turing Test and the Evaluation of Generative Music Systems. *Computer Music Journal, 33*(2), 48-70. doi:doi:10.1162/comj.2009.33.2.48

Attenborough, D. "Life Story, episode 5: Courtship." *BBC Two.* November 20, 2014. http://www.bbc.co.uk/programmes/b04q1rwy

Bateson, G. (1979). *Mind and Nature: A Necessary Unity*. New York: E. P. Dutton.

Berger, J. *Ways of Seeing.* London: BBC and Penguin Books, 1972.

Bogost, I. (2006). *Unit Operations: An Approach To Videogame Criticism*. Cambridge, Massachusetts: The MIT Press.

Boden, M. A. (2004). *The Creative Mind: Myths and Mechanisms*. (Second ed.). London: Routledge.

Bostrom, N. (2014). *Superintelligence: Paths, Dangers, Strategies*. Oxford: Oxford University Press.

Carroll, N. *Philosophy of Art: A Contemporary Introduction*. London: Routledge, 1999.

Carvalhais, M. (2016). *Artificial Aesthetics: Creative Practices in Computational Art and Design*. Porto: U.Porto Edições.

Cope, D. (2005). *Computer Models of Musical Creativity*. Cambridge, Massachusetts: The MIT Press.

Damásio, A. (2010). *Self Comes to Mind: Constructing the Conscious Brain*. New York: Pantheon Books.

Damásio, A. (2017). *A Estranha Ordem das Coisas* (L. Oliveira Santos, Trans.). Lisboa: Temas & Debates.

Danto, A. C. "The Artworld." *The Journal of Philosophy* 61, no. 19 (1964): 571-84.

Danto, A. C. *What Art Is.* New Haven, CT: Yale University Press, 2013.

DeLanda, M. (1991). *War in the Age of Intelligent Machines*. New York: Zone Books.

Dennett, D. C. (1991). *Consciousness Explained*. London: Penguin Science.

Deutsch, D. (2011). *The Beginning of Infinity: Explanations that Transform the World*. London: Allen Lane.

Dewey, J. *Art as Experience*. New York, NY: Perigee Books, 1934.

Dickie, G. "Defining Art." *American Philosophical Quarterly* 6, no. 3 (1969): 253-56.

DiSalvo, D. (2011). *What Makes Your Brain Happy and Why You Should Do the Opposite*. Amherst, NY: Prometheus.

Eagleman, D. M. (2011). *Incognito: The Secret Lives of the Brain*. New York: Pantheon Books.

English, M., Kaplan, G., and Rogers, L. J. "Is painting by elephants in zoos as enriching as we are led to believe?" *PeerJ* 2:e471 (2014).

Galanter, P. (2006). Generative Art and Rules-Based Art. *Vague Terrain*. Retrieved from http://philipgalanter.com/downloads/vague_terrain_2006.pdf

Gazzaniga, M. S. (2011). *Who's in Charge?: Free Will and the Science of the Brain*. New York: Ecco.

Goldman, J. G. "Creativity: The Weird and Wonderful Art of animals." *BBC Future.* July 24, 2014. http://www.bbc.com/future/story/20140723-are-we-the-only-creative-species

Goldstein, E. B. *Sensation and perception*. Ninth ed. Belmont, CA: Wadsworth, Cengage Learning, 2013.

Gottschall, J. (2012). *The Storytelling Animal, How Stories Make Us Human.* New York, NY: Houghton Mifflin Harcourt, 2012.

Hayles, N. K. (2005). *My Mother Was a Computer: Digital Subjects and Literary Texts*. Chicago, IL: The University of Chicago Press.

Hofstadter, D. (2007). *I Am A Strange Loop*. Cambridge, Massachusetts: Basic Books.

Humphrey, N. (2011). *Soul Dust: The Magic of Consciousness* Princeton, New Jersey: Princeton University Press.

Hunt, E. *"Pair of glasses left on US gallery floor mistaken for art." The Guardian.* May 27, 2016. https://www.theguardian.com/us-news/2016/may/27/pair-of-glasses-left-on-us-gallery-floor-mistaken-for-art

Jefferson, G. "The Mind of Mechanical Man." *British Medical Journal* 1, no. 4616 (1949): 1105–10.

Kawase, H, Okata, Y., and Ito, K.. "Role of Huge Geometric Circular Structures in the Reproduction of a Marine Pufferfish." *(Nature) Scientific Reports* 3, no. 1 (2013).

Kelly, K. (2016). *The Inevitable*. New York: Penguin Books.

Levinson, J. "Defining Art Historically." *British Journal of Aesthetics* 19, no. 3 (1979): 21-33.

Margulis, E. H. "Music is not for ears." *Aeon Essays*. November 2, 2017. https://aeon.co/essays/music-is-in-your-brain-and-your-body-and-your-life

Metzinger, T. (2009). *The Ego Tunnel: The Science of the Mind and the Myth of the Self.* New York: Basic Books.

Morowitz, H. J. (2002). *The Emergence of Everything: How the World Became Complex*. New York: Oxford University Press.

Nagel, T. (1974). What is it Like to be a Bat? *The Philosophical Review, 83*(4), 435-450.

Oliveira, A. (2017). *The Digital Mind: How Science is Redefining Humanity*. Cambridge, Massachusetts: The MIT Press.

Penrose, R. *The Emperor's New Mind: Concerning Computers, Minds and The Laws of Physics.* Oxford: Oxford University Press, 1989.

Pinker, S. (1999). *How the Mind Works*. London: Penguin Books.

Ramachandran, V. S. (2011). *The Tell-Tale Brain: A Neuroscientist's Quest for What Makes Us Human*. New York: W. W. Norton & Company.

Russell, B. *The Problems of Philosophy.* Oxford: Oxford University Press, 1912. 2001.

Searle, J. R. (1981). Minds, Brains, and Programs. In D. Hofstadter & D. C. Dennet (Eds.), *The Mind's I: Fantasies and Reflections on Self and Soul* (pp. 353-373). New York: Basic Books. (Reprinted from: 2000).

Tegmark, M. (2017). *Life 3.0: Being Human in the Age of Artificial Intelligence*. New York: Alfred A. Knopf.

Turing, A. M. (1950). Computing Machinery and Intelligence. *Mind, 59*, 433-460.

Turing, A. M. (1996). Intelligent Machinery, A Heretical theory. *Philosophia Mathematica, 4*, 256-260.

Uzgalis, W. "John Locke." In *The Stanford Encyclopedia of Philosophy (Fall 2017 Edition),* edited by Edward N. Zalta. April 24, 2017. https://plato.stanford.edu/archives/fall2017/entries/locke/

Wagner, S.-C. (2017). *Poietry: Challenging Solitude and the Improbability of Communication* (D. Benedek, Trans.). Berlin: de Gruyter.

Wittgenstein, L. (1921). *Tractatus Logico-Philosophicus* (D. F. Pears & B. F. McGuinness, Trans.). Abingdon: Routledge.
Wittgenstein, L. *Philosophical Investigations*. Translated by G.E.M. Anscombe, P.M.S Hacker and J. Schulte. Revised 4th edition by P.M.S. Hacker and J. Schulte. West Sussex: Wiley-Blackwell, 1953. 2009.
Zacks, J. M. (2015). *Flicker: Your Brain on Movies*. Oxford: Oxford University Press.

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Promoting Underrepresented Culture through Media Arts Collaboration

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Abstract

This paper presents the practice of designing mediation technologies as artistic tools to expand the human repertoire. Three art-science collaborations: *Mandala*, *Imagining the Universe*, and *Resonance of the Heart* are elaborated as proof-of-concept case studies. Scientifically, the empirical research examines the mappings from (bodily) action to (sound/visual) perception in technology-mediated performing art. Theoretically, the author synthesizes media arts practices on a level of defining general design principles and post-human artistic identities. Technically, the author implements machine learning techniques, digital audio/visual signal processing, and sensing technology to explore post-human artistic identities and give voice to underrepresented groups. Realized by a group of multinational media artists, computer engineers, audio engineers, and cognitive neuroscientists, this work preserves, promotes, and further explores underrepresented cultures with emerging technologies.

Keywords

Art-science collaboration, multimedia live performance, mediation technology, body movement, sensing technology, machine learning, HCI, augmented-reality, posthuman, artist identity and ownership, underrepresented culture, cultural arts

Introduction

Cultural hegemony is a form of domination that gives little opportunity to minority cultures like Tibetan culture to survive and grow (Leavis 1930; Sautman 2006). Tibetan culture, which uniquely embraces the legacy of both Indian and Chinese Buddhism (Stein 1972), has stunning arts such as the Mandala Sand Art (Anderson 2002), monastic throat-singing (Smith et al. 1967), and Cham dance (de Nebesky-Wojkowitz 1976). Compared with its contribution to the world, such as its contemplative techniques and improvement of well-being (Kumar 2003; Marom 2004; Thompson 2006), Tibetan intangible heritage is highly underrepresented (Bishop 1989; Goldstein and Kapstein, 1998; Dodin and Räther 2001; Lopez 2012). In fact, the underrepresentation is an issue that affects all cultures of marginalized groups in our time. As a media artist and an interdisciplinary researcher, my ultimate goal is to promote underrepresented cultures through my work in music composition, vocal expression, multimedia performance, and technology development.

Deeply anchored in Tibetan culture, my research situates the design, development, and evaluation of media technologies. These innovative technologies are then used as artistic tools to create novel expressions to make a social impact. By exploring the healing power of the voice, I focus on how vocalists can enhance their vocal expressions with technology that facilitates cross-cultural communication and contemplative practices; by initiating and fostering art-science collaborations and turning the research into art practices, I hope to inspire other artists, technologist, and scholars to join me on the journey of promoting underrepresented cultural values through their work.

Related work

From an engineering perspective, I design and develop Digital Musical Instruments (DMI) and human-computer interactive systems, which implement machine learning techniques and 3D tracking to capture and identify the body movement of a vocalist. The vocalist's gestural data are simultaneously mapped into audio/visual events that activate vocal processing effects, such as reverberation and chorus, and manipulate computer graphics in a live performance.

From a theoretical perspective, I investigate existing theories in the context of music subjectivity (Cumming 2000; Patel 2010; Beard & Kenneth 2016), affordance (Gibson 1966; Reybrouck 2012; Krueger 2014), aesthetic and economic efficiency (Simon 1969; Roads 2015), culture constraints and social meaning-making (Hirschfeld and Gelman 1994; Meyer 2008; Dillon 2009; Chagas 2014), and conceptualize this body of knowledge into a series of DMI design principles, which are currently absent in electroacoustic vocal performance.

From a scientific perspective, I facilitate quantitative and qualitative human subject research to evaluate my design principles and examine the body-mind mappings from gestures to sound perception. Different from typical DMI evaluations that examine mapping relationships through user studies (Wanderley and Orio 2002), my original evaluation framework provides scientific justification for validating DMI and body-sound mappings in electroacoustic vocal performance from the audience's perspective (Wu et al. 2016). This unique approach provides empirical evidence for identifying the audience's degree of musical engagement from synchronization, to embodied attuning, and to empathy—the human connections (Leman 2008).

Art-science Collaboration

Given the interdisciplinary nature of my work and my long-term engagement with international computer science, music, and media arts research institutions, such as Center for Computer Research in Music and Acoustics (CCRMA) and Artificial Intelligence Laboratory at Stanford University, I often work closely with researchers in computer science, electronic engineering, and neuroscience fields. I aim to connect research and artistic practices within and outside of academic settings.

As the engineer Richard Hamming pointed out (1997, cited by Roads 2015), it is insignificant if the novelty and innovation make no cultural impact on human history. Through implementing our designed innovative technologies to compose proof-of-concept multimedia art pieces, I strive to create intriguing work that translates ancient Tibetan contemplative philosophy and culture to both a musical and a spiritual experience. The aspiration of my work is to capture the natural forms of human expression and embody them artistically in real-time by bringing an ancient Tibetan art form and its contemplation to the digital world and the 21st century.

In the following sessions, I will elaborate three case studies and a scientific research on body-mind connection to demonstrate how my proof-of-concept audio-visual pieces serve as a direct result of interdisciplinary collaborations between musicians, visual artists, technologists, and scientists. Our collaborative goal is to address the questions of how media arts technology and new artistic expressions can expand human repertoire, and how to promote underrepresented culture and cross-cultural communication through these new expressions.

The Mandala

In Tibet, as part of a spiritual practice, monks create mandalas with colored sand (Bryant, 2003). The creation of a sand mandala may require days or weeks to complete. When finished, the monks gather in a colorful ceremony, chanting in deep tones (Tibetan throat singing) as they sweep their Mandala sand spirally back into nature. This symbolizes the impermanence of life.

In this project, I aim to create an intriguing piece that translates this ancient philosophy to a multimedia arts and cultural experience through augmented reality and music composition. I computer-simulated and choreographed Tibetan Sand-Mandala vocal and instrumental composition. The performer activates with her arms 4.5 million particles using a physical computing and motion-tracking system (Wu, 2015; Wu & Conti, 2015).

To realize this piece, my collaborator introduced me to an open-sourced graphic and dynamic modeling framework CHAI3D (Conti, 2003), to simulate in real-time the physical interaction between the captured hand motions of the performer and the small mass particles composing the virtual Mandala. The mapping between the hands of the performer and their models in the simulation is performed using a mapping technique (Conti and Khatib. 2005) called *workspace expansion* that relies on progressively relocating the physical workspace of the devices mapped inside of the virtual environment towards the operator's area of activity without disturbing his or her perception of the environment. This approach allows me to interact with high accuracy in a very large virtual environment while moving my hands within a reasonably small workspace.

The piece includes three movements: *Construction*, *Climax*, and *Destruction*. At the beginning of the piece, hand motions from the vocalist were directed to initiate the *Construction* of the virtual Mandala. During the *Climax*, musicians were focusing on musical improvisation while the virtual Mandala was self-directed and presenting animation, such as rotation, twisting and glitter effects. Experimental low-tone throat singing and explosions of violent soprano interjections, comes to symbolize the extreme conflicts and ecstasy in life, the extraordinary highs and lows, the sharp rises and falls of life as it is experienced, ending with a sharp fade out into the deconstruction of the mandala. The *Destruction*, which underscores the eternal nature of impermanence, occurs near the coda of the audio-visual piece through the hand motions from the singer.

Figure 1: Live performance of the *Mandala*.

In 2013, as part of a multimedia live performance created at Stanford University and an invited performance at the Third International Buddhist Youth Conference in the Hong Kong Institute of Education, an interactive display of sand Mandala was dynamically simulated and choreographed with the vocal and instrumental compositional-improvisation. The first performance at Stanford University took place before an audience of Silicon Valley entre-

preneurs and researchers, while the second performance occurred in Hong Kong, before an eastern, Buddhist audience. Both audiences showed enthusiasm for the culture content, and the science and technologies behind the scene that creates the magic, both during and after the concerts.

In 2017, I completed the postproduction and realized a fixed audio-visual piece of this work. In March 2018, this fixed-media piece was presented at the national conference of The Society for Electro-Acoustic Music in the United States (SEAMUS) 2018. The performance piece and the fixed-media piece were well received by both the Western audience and the Tibetan diaspora. Through this media art collaboration, I innovatively provide a quick, yet rich presentation to simulate the Tibetan Mandala sand arts with musical expression; I aesthetically explore the ancient Buddhist philosophy of impermanence; and the visibility of traditional Tibetan cultural practices have been increased to the "twitter generation", who has less patience to rediscover those transcendent human treasures. A video of this multimedia live performance piece's premier can be viewed at: (http://tinyurl.com/ku5cg4f). A fix-media audio-visual piece can be viewed at: (https://goo.gl/5TgjJF).

Imagining the Universe

Sponsored by the National Aeronautics and Space Administration (NASA) and Stanford University [1], a live-performance telematics concert named "Imagining the Universe – Music, Spirituality, and Tradition" was held at the Knoll Hall at Stanford University. The concert was an international collaboration in real time that was broadcast live via the Internet, connecting musicians and scholars at six research institutions from Stanford, Virginia Tech, UC Santa Barbara, University of Guanjuato (Mexico), to Shangri-La Folk Music Preservation Association and Larung Gar Five Sciences Buddhist Academy (Sichuan Province, China). The concert was dedicated to the Venerable Khenpo Sodargye Rinpoche[2], an influential Tibetan Buddhist scholar, who attended the concert along with approximately 400 other audience members. It combines research, artistic creation and performing art in connection with the integration of cutting edge technology, building cross-cultural relationships through the lens of artistic and contemplative practice and interdisciplinary collaboration (Wu & Heauermann, 2016).

The technology component of this project explores ways of connecting cultures and collaborative artistic partners over long distances, through the use of the Jacktrip[3] application for online jamming and concert technology. Jacktrip was first developed in the early 2000s. It is an open source, Linux and Mac OSX-based system, used for multi-machine network performance over an Internet connection. Jacktrip supports any number of channels of bidirectional, high quality, low-latency, and uncompressed audio-signal streaming (Chafe and Gurevich 2014). More and more musicians have started using this emerging technology to play tightly synchronized music with other musicians who are located in different cities or countries. Without paying significant transportation costs, we exchanged musical ideas, rehearsed, recorded, and improvised together in different geological locations and for the final concert presentation. A link of the concert can be reviewed at: https://youtu.be/OaBNyAgiQP8

Figure 2: Live performance of the *Imagining the Universe*.

As part of this concert's research contribution, my research team and I built the *Tibetan Singing Prayer Wheel* (TSPW), combining both the meditative and musical associations of two Tibetan sacred instruments into one novel Digital Musical Instrument (DMI). The cultural heritage and meditative associations of the Tibetan prayer wheel, Tibetan singing bowl, and Buddhist chanting inspired this instrument (Wu et al., 2015). In this design, I hope to preserve these associations while adding digitized gestural mapping and control. At the aesthetic and compositional level, inspired by the thematic connection of the similar circular gestures of spinning a prayer wheel and rubbing a singing bowl, I designed a physical-motion-sensing controller that maps sensed circular motions (wheel spinning) and a steady raising/lowering gesture to a variety of outputs, including corresponding virtual circular motions (exciting the modeled bowl), changes in vocal processing, and amplitude modulation, as shown in Figure 3.

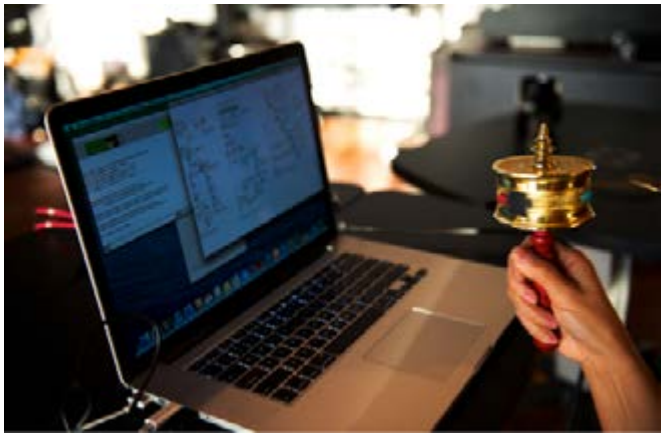

Figure 3: A Tibetan Singing Prayer Wheel

[1] https://news.stanford.edu/features/2014/imagining-the-universe/
[2] http://www.khenposodargye.org/
[3] https://ccrma.stanford.edu/groups/soundwire/software/jacktrip/

As a novel DMI, the TSPW was successfully integrated into multiple pieces with Western classical instruments, Tibetan traditional instruments and a variety of electronic/digital instruments. The concert provides evidence of strong theatricality when using TSPW; it also shows the added expressive possibilities that TSPW provides to the musician. Interestingly, 36 audience members came by to spin the TSPW after the performance, and showed great interests in playing the TSPW. This positive feedback from the audience motivated us to conduct two follow-up projects: one is a series of sound installations, and the other one is an empirical research on human research.

In early 2015, we first applied the TSPW to a sound installation at the Maker Faire4, at the Silicon Valley, in Northern California. A broader user group of around 200 people, including laypersons, children, and people who enjoy technology at all age participated in this sound installation. Another three similar sound installations were realized later in the same year, respectively exhibited at the California NanoSystems Institute (CNSI), UCLA, and Louisiana State University's Digital Media Center. Around more than 500 people participated in these three sound installations. They were mostly students and faculty members, researchers, and community members at the research institutions. An illustration of the sound installation at the Maker Faire is presented in Figure 4.

Figure 4: A TSPW installation at MakerFaire2015

From my observation, using real-time body movement/gesture to control and modify a sound's properties helps people to experience sound in an intimate, conscious, and meditative way. Most of the participants seemed to be able to catch subtle changes of the sound that the prayer wheel made with their own gestural control and physical interaction. With the haptic feedback that the TSPW naturally provides, participants can easily pick up the instrument and play around with it, understand what it does, and how to be creative with it in an engaging way.

Overall, participants' engagement with sound by using the TSPW was positive when they generated and affected sounds by using their own gestures and body movements. . Playing TSPW provides an intuitive way to connect users' physical movements to their own sound experience, as they are making, and "aesthetically" to appreciating, perceiving, and enjoying sound with their own physical form. This series of installations was the first step towards the rigorous scientific validation of the TSPW and my research on (bodily) action–(sound) perception mapping strategies for real-time electroacoustic vocal performance, especially for identifying the audience's degree of musical engagement.

Resonance of the Heart

The third case study, *Resonance of the Heart,* was inspired by a "Kōan" story in Chinese Zen Buddhism, called "印心", which describes a Zen master and his disciple's thoughts resonant without any verbal communication. This means these two enlightened human beings only communicated through their body-mind attuning in a profound lucid way. I have found this phenomenon specifically interesting, as this ideology aligned with my long-term investigations on body-mind connections through mediation technology development and media arts collaborations.

Indeed, with the assistance of the innovative mediation technology, nowadays' artists are entering into an "augmented human" era–some scholars called it "posthuman era" (Fukuyama 2003; Hayles 2008). Although many scholars concern challenges of artistic identity, ownership issues, and body boundaries in the posthuman era and some may even have a negative view upon these challenges, I perceive them as an opportunity to help our human species move forward. For this debate, I support Marcos Novak's view point, that with setting the humanities as the ultimate goals and ends, and with the technology as means to promote/accomplish excellence in the humanities[5], we human can overcome and go far beyond our current human condition. Therefore, posthumans could potentially become better humans, if we put great efforts and faith in this direction. This is also the overall goal of my ongoing research in "Embodied Sonic Meditation", where I examine how bodily activities can help increase our sonic awareness and open up our creative mind, and how an augmented body equipped with mediation technology can become part of the art itself or part of the artists him/herself.

To realize *Resonance of the Heart*, I used an infrared sensing device and a series of touchless hand gestures to control a real-time tracking system that I developed producing various sonic and visual results. I collaborated with AI researchers to design and implement machine-learning algorithms and techniques to capture complex and subtle ritual hand gestures called "Mudras" (Wu et al. 2017a). Mudra data were then mapped in real-time to control Tibetan throat singing effect, overtone singing effect, vocal reverberations and granular effects, and a 4-dimensional

[4] https://makerfaire.com/

[5] http://themas.mat.ucsb.edu/

Buddhabrot fractal deformation (Situngkir 2005). Figure 5 shows a glimpse of this ongoing project.

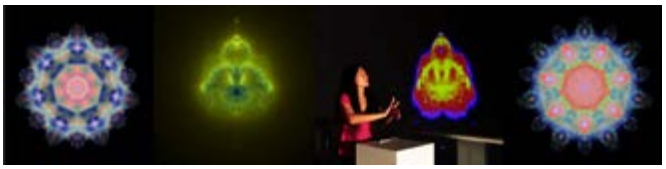

Figure 5: Mudras-conducted Buddhabrot deformation

In spring 2017, I used this audio-visual system as well as the TSPW as pedagogical tools to teach fifteen undergraduate students a course called "Embodied Sonic Meditation" at the College of Creative Studies[6] at the University of California, Santa Barbara. The unifying theme of this course is an engagement with sonic awareness, music technology, self-exploration, and non-hierarchical social relationships of music creation and appreciation.

I invited my collaborators to give guest lectures and play telemetric network gigs with the students during the course being taught. Students participated in listening, singing, improvisation, field recording, and interactive music making using the mediation technology that my research team and I developed. I aim to open up a safe and non-judgmental space to touch, move, and inspire students to express their creative nature, embrace their inner selves, and genuinely connect with others by enhancing their sonic awareness and their ability to listen, understand, and communicate cross-culturally through novel music expressions with embodied experience. As a result, most of the students demonstrated mastery of contemplative reflection, creative expression, transpersonal and cross-cultural practices, and scholarly thinking. Figure 6 shows a moment at one of the "Embodied Sonic Meditation" class, where students were online jamming with my collaborator at Stanford University, using Jacktrip application for online jamming and concert technology and the audio system of *Resonance of the Heart*.

Figure 6: "Embodied Sonic Meditation" class activities

6 https://www.ccs.ucsb.edu/

Embodied Sonic Meditation

The three case studies provide the fundamentals of "Embodied Sonic Meditation" (Wu et al. 2017b), an artistic practice rooted in the richness of the Tibetan contemplative culture, embodied cognition (Varela et al. 1991; Lakoff 1999), and "deep listening" (Oliveros 2005). This sonic art practice is based on the combination of sensing technology and human sensibility. Through this practice, we encourage people to fully understand and appreciate abstract electric and electroacoustic sounds and how these sounds are formed and transformed (cognitive process), by providing them interactive audio systems that can tightly engage their bodily activities to simultaneously create, sculpt, and morph the sonic outcomes themselves, using their body motions (embodiment). This ongoing project aims to further explore gesture-controlled, vocal-processing DMI design strategies and experimental sound education.

To further examine this artistic practice and formulate a body-mind sound theory, in 2016, I collaborated with cognitive neuroscientists at Stanford University to scientifically study audience perceptions for (bodily) action to (sound) perception mapping strategies. Specifically, we used TSPW as an evaluation case study to conduct human-subject research. We examined the way it maps horizontal spinning gestures to vocal processing parameters. We facilitate quantitative and qualitative research to evaluate the design principles and examine the body-mind mappings from gestures to sound perception. My proposed methodology differs from typical DMI evaluations that examine mapping relationships through user studies (Wanderley and Orio 2002) because mine was built on O'Modhrain's (2011) framework. It evaluates a DMI and body-sound mappings from the audience's perspective (Wu et al. 2016). This approach has been little studied and our research is the first empirical evaluation of a DMI for augmenting electroacoustic vocal performance from the audience's perspective.

We hypothesize that the levels of perceived expression and audience engagement increase when the mapping is (1) synchronized (such that the sensed gestures in fact control the processing in real time) and (2) intuitive. I composed and filmed six songs with the singer simultaneously using the TSPW. In two experiments, two alternative soundtracks were made for each song. Experiment 1 compared the original mapping against a desynchronized alternative, Experiment 2 compared the original mapping (faster rotation causing a progressively more intense granular stuttering effect on the voice) to its inverse. All six songs were presented to two groups of participants, randomly choosing between alternate soundtracks for each song. This method eliminates potential variability in perceived expressiveness of different performers and videos. Responses were evaluated via questionnaire. 50 viewers reported higher engagement and preference for the original versions, though level of perceived expression only significantly differed in Experiment 1. This methodology is proved to be effective

to be used as a research framework in future DMI evaluation both in design and mapping strategies from bodily action to sound perception.

Conclusion

Throughout this series of art-science collaborations and scientific investigation, I have demonstrated how music, art, science, culture, spirituality, tradition, and media technology can connect people, especially when used with a clear and conscious intent of building cross-cultural exchange. Our work also shows that media arts have the potential to open new windows onto underrepresented cultural groups, such as Tibetan people. During this six years of collaborating with researchers in both Humanities, STEM and Social Science field from different cultural, ethnic, and racial backgrounds, I have discovered that the crucial key which leads to the success of these interdisciplinary collaborations is to be open-minded, to be humble, to be grateful, and to be accountable. This way, mutual trust and respect can be cultivated effortlessly.

Through meditative cultural and art practice, my collaborators, my students, and I become more connected with ourselves, rippling out with a larger intent to connect in an open way to others, bridging cultural divides as well as art and science. Most importantly, our work not only preserves and promotes Tibetan contemplative heritage with emerging technologies but also projects the marginalized Tibetan cultural values and group identity into the cutting-edge art and technology context of contemporary society. Overall, this practice-based research leads to the emergence of entirely new fields of scholarship and artistic creation result in significant changes on how concepts are formulated in disciplines of the humanities.

Acknowledgements

I thank Curtis Roads, Clarence Barlow, Chris Chafe, Paulo Chagas, and Matt Wright for their mentorship and support. Thanks to Audio Engineering Society, University of California, CCRMA, Stanford Arts Institute, and National Academy of Sciences Sackler Fellowship for their funding support. My sincere thanks to all my brilliant research collaborators, especially thanks to Francois Conti, Donghao Ren, and Yoo Yoo Yeh.

References

1. Anderson, Tom. "Mandala Constructing Peace Through Art." Art Education 55, no. 3: 33-39. 2002.
2. Beard, David, and Kenneth Gloag. Musicology: the Key Concepts. Routledge. 2016.
3. Bishop, Peter. “The Myth of Shangri-La: Tibet, Travel Writing, and the Western Creation of a Sacred Landscape.” Berkeley: University of California Press. 1989.
4. Bryant, Barry. “The wheel of time sand mandala: Visual scripture of Tibetan Buddhism.” Snow Lion Publications, 2003.
5. Chafe, Chris, and Michael Gurevich. “Network Time Delay and Ensemble Accuracy: Effects of Latency, Asymmetry." In Audio Engineering Society Convention117. San Francisco: Audio Engineering Society. 2004.
6. Chagas, Paulo C. Unsayable Music: Six Essays on Music Semiotics, Electroacoustic and Digital Music. Leuven: Leuven University Press. 2014.
7. Conti, François. The CHAI libraries. No. LSRO2-CONF-2003-003. 2003.
8. Conti, Francois, and Oussama Khatib. "Spanning large workspaces using small haptic devices." In Eurohaptics Conference, 2005 and Symposium on Haptic Interfaces for Virtual Environment and Teleoperator Systems, 2005. World Haptics 2005. First Joint, pp. 183-188. IEEE, 2005.
9. Cumming, Naomi. The Sonic Self: Musical Subjectivity and Signification. Bloomington: Indiana University Press. 2000.
10. de Nebesky-Wojkowitz, René. Tibetan Religious Dances: Tibetan Text and Annotated Translation of the ’Chams Yig. Vol. 2. Berlin: Walter de Gruyter. 1976.
11. Dillon, Steve. “Music, Meaning and Transformation: Meaningful Music Making for Life.” Cambridge: Cambridge Scholars Publishing. 2009.
12. Dodin, Thierry, and Heinz Räther, eds. Imagining Tibet: Perceptions, Projections, and Fantasies. New York: Simon and Schuster. 2001.
13. Gibson, James Jerome. The Senses Considered as Perceptual Systems. Houghton: Mifflin. 1966.
14. Hamming, Richard R. Art of Doing Science and Engineering: Learning to Learn. CRC Press, 1997.
15. Hayles, N. Katherine. “How we became posthuman: Virtual bodies in cybernetics, literature, and informatics.” University of Chinago Press, 2008.
16. Hirschfeld, Lawrence A., and Susan A. Gelman. Mapping the Mind: Domain Specificity in Cognition and Culture. Cambridge: Cambridge University Press. Eds,1994.
17. Hunt, Andy, Marcelo Wanderley, and Ross Kirk. "Towards a model for instrumental mapping in expert musical interaction." In Proceedings of the 2000 International Computer Music Conference, pp. 209-212. 2000.
18. Kumar, Sameet M. "An Introduction to Buddhism for the Cognitive-Behavioral Therapist." Cognitive and Behavioral Practice 9, no. 1: 40-43. 2003.
19. Krueger, Joel. "Affordances and the Musically Extended Mind." Frontiers in Psychology 4: 1003. 2014.
20. Lakoff, George, and Mark Johnson. “Philosophy in the Flesh.” Vol. 4. New York: Basic Books. 1999.
21. Leavis, Frank Raymond. “Mass Civilisation and Minority Culture.” Vol. 32. Cambridge UP. 1930.
22. Leman, Marc. “Embodied Music Cognition and Mediation Technology.” Cambridge: MIT Press. 2008.
23. Lopez Jr, Donald S. Prisoners of Shangri-la: Tibetan Buddhism and the West. Chicago: University of Chicago Press. 2012.
24. Marom, Maya K. "Spiritual Moments in Music Therapy: A Qualitative Study of the Music Therapist's Experi-

ence." Qualitative Inquiries in Music Therapy, no. 1: 37-76. 2004.
25. Meyer, Leonard B. Emotion and Meaning in Music. Chicago: University of Chicago Press. 2008.
26. Oliveros, Pauline. Deep Listening: a Composer's Sound Practice. New York: IUniverse. 2005.
27. O'modhrain, Sile. "A Framework for the Evaluation of Digital Musical Instruments." Computer Music Journal 35, no.1: 28-42. 2011.
28. Patel, Aniruddh D. Music, Language, and the Brain. Oxford: Oxford University Press. 2010.
29. Reybrouck, Mark. "Musical Sense-making and the Concept of Affordance: an Ecosemiotic and Experiential Approach." Biosemiotics 5, no. 3: 391-409. 2012.
30. Roads, Curits. Composing Electronic Music: A New Aesthetic. New York: Oxford Press. 2015.
31. Sautman, Barry, ed. Cultural Genocide and Asian State Peripheries. Springer. 2006.
32. Smith, Huston, Kenneth N. Stevens, and Raymond S. Tomlinson. "On an Unusual Mode of Chanting by Certain Tibetan Lamas." The Journal of the Acoustical Society of America 41, no. 5: 1262-1264. 1967.
33. Simon, Herbert A. The Sciences of the Artificial, 1st edn. 1981, 2nd. Cambridge: MIT Press, MA. 1969.
34. Situngkir, Hokky. What is the Relatedness of Mathematics and Art and Why We Should Care? Bandung Fe Institute. 2005.
35. Stein, Rolf Alfred. Tibetan Civilization. Stanford: Stanford University Press. 1972.
36. Thompson, Evan. "Neurophenomenology and Contemplative Experience." The Oxford Handbook of Science and Religion, pp: 226-235. 2006.
37. Varela, Francisco, Evan Thompson, and Eleanor Rosch. The Embodied Mind: Cognitive Science and Human Experience. Cambridge, MA: MIT Press. 2017.
38. Wanderley, Marcelo Mortensen, and Nicola Orio. "Evaluation of Input Devices for Musical Expression: Borrowing Tools from HCI." Computer Music Journal 26, no. 3: 62-76. 2002.
39. Wu, J. Cecilia. "The Expressionist: A Gestural Mapping Instrument for Voice and Multimedia Enrichment." The International Journal of New Media, Technology and the Arts 10, no. 1. 2015.
40. Wu, J. Cecilia, and François Conti. The Virtual Mandala." in Proceedings of the 21st International Symposium on Electronic Art (ISEA). Vancouver, Canada. 2015.
41. Wu, J. Cecilia, and Heuermann, Lee. "The Impact of Contemplative Practice on 'Being Peace and the Power of the Voice' - a Collaborative Project on Music, Meditation and the Healing Quality," in proceedings of the 3rd International Symposium on Contemplative Practices for the 21st Century University. Virginia, US. 2016.
42. Wu, J. Cecilia, Madeline Huberth, Yoo Hsiu Yeh, and Matthew Wright. "Evaluating the Audience's Perception of Real-time Gestural Control and Mapping Mechanisms in Electroacoustic Vocal Performance." in Proceedings of the International Conference on New Interfaces for Musical Expression (NIME), Brisbane, Australia, pp. 206-211. 2016.
43. Wu, J. Cecilia, Yijun Zhou, Mark Rau, Yun Zhang, and Matthew Wright. "Towards Robust Tracking with an Unreliable Motion Sensor Using Machine Learning," in Proceedings of the International Conference on New Interfaces for Musical Expression (NIME), Copenhagen, Denmark, pp. 42-47. 2017a.
44. Wu, J. Cecilia, Smith, Julius O., Zhou,Yijun, and Matthew Wright. "Embodied Sonic Meditation and its Proof-of-Concept: "Resonance of the Heart" In Proceedings the 43rd International Computer Music Conference, pp. 110-114. 2017b.
45. Wu, J. Cecilia, Yoo-Hsiu Yeh, Romain Michon, Nathan Weitzner, Jonathan S. Abel, and Matthew Wright. "Tibetan Singing Prayer Wheel: a Hybrid Musical-spiritual instrument Using Gestural Control." in Proceedings of the International Conference on New Interfaces for Musical Expression (NIME), Brisbane, Australia, pp. 206-211. 2016.

Authors Biographies

Jiayue Cecilia Wu: Originally from Beijing, Jiayue Cecilia Wu is a scholar, composer, multimedia performer, and audio engineer. Cecilia earned her Bachelors of Science degree in Design and Engineering in 2000. Upon winning the MTV Asian Beat contest, Universal Music Group identified her talent and hired her as a music producer in Hong Kong. She then worked as a professional musician for ten years. In 2010, Cecilia produced her original album of spiritual electronic music, Clean Your Heart. In 2013, Cecilia obtained her Master's degree in Music, Science, and Technology at Center of Computer Research in Music and Acoustics (CCRMA) at Stanford University, where she focused on computer-assisted composition and audio engineering. Since 2013, she has worked with Dr. Curtis Roads at Media Arts and Technology Program at University of California, Santa Barbara, where she is completing her Ph.D. degree. As an audio engineer, she received a research grant award from Audio Engineering Society. As a musician, she received an award from the California State Assembly for being a positive role model in sharing Chinese culture. As a multimedia artist, she received the "Young Alumni Arts Project Grant Award" from Stanford University. As a scholar, she has been awarded a UC Central Campus Diversity Fellowship, a UC Central Campus Humanities Research Fellowship, as well as a National Academy of Sciences Sackler Student Fellowship. She recently has been appointed to a tenure-track position as an Assistant Professor at the College of Arts and Media at University of Colorado, Denver.

Bio Art as a Trading Zone: A Creolized Art Form of Biology and Art

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Keywords

Bio art, Trading zone, Creolization, Shared context, Microbial art project

Abstract

This paper explores the identity of bio art in terms of trading between an artist and a bio lab and looks into the creation process of bio art through the concept of creolization, in order to consider bio art as a creolized art form of biology and art. The American physicist Peter Galison refers to the term 'trading zone' as the boundary binding together the heterogeneous subcultures and considers 'creolization' as the process by which the interaction among different disciplines builds a new interdisciplinary field. Galison's concepts can be applied to bio art where art and biology interact. Bio art is a trading zone that leads trading activities between an artist and a bio lab. Within the trading zone, artists and scientists trade their own goals on the premise of a shared context. As a result, the creation process of bio art shows creolization occurring within the trading zone.

The word 'creole' refers to people who are descended from White European colonial settlers. Each creole has a mixed identity and speaks a mixed language. That is why some linguists regard 'creole' as a type of mixed language and consider the mixing process of different languages as the term 'creolization'. It is especially used to refer to the mixing process of local languages with European languages (Burke, 2009). Furthermore, the concept of creolization has evolved to have different meaning at different times and has been more widely used in various disciplines. For the Argentinian historian Jose Luis Romero, creolization refers to the way in which the descendants of the early Spanish settlers adopted native customs and indigenous products in the colonial period (Romero, 1976). Meanwhile, the Swedish anthropologist Ulf Hannerz describes creolization as the emergence of a new culture out of the mixture of two or more cultures (Hannerz, 1987), and the French sociologist Nicole Lapierre says that creolization is the unpredictable process that creates encounters, interferences, shocks, chords and discords among cultures (Lapierre, 2004). Even the American physicist Peter Galison states that people from the different subcultures of physics communicate in a mixed language that can be described as a scientific creole (Galison, 1997).

Among them, Galison's creolization is noteworthy in that it explains the interdisciplinary integration beyond language and culture. He regards 'science' as the totality of interactions among heterogeneous subcultures such as theory, experiment, and instrument making, and describes the term 'trading zone' as the bounded area in which the heterogeneous subcultures can communicate (Galison, 1997). In the trading zone, there are the problems related to pidginization and creolization of scientific languages. A pidgin usually designates a simple contact language used as a means of communication among people who do not share a common language; pidginization is the process of simplification by which a pidgin is produced (Muysken & Smith, 1995). On the other hand, a creole can be referred to as a pidgin extended and complexified to the point where it can serve as a stable native language; creolization is the process leading up to such a newly created natural language (Muysken & Smith, 1995). Galison has expanded the meaning of creolization by applying the dynamics of contact languages to the interactions among scientific subcultures. He explains the linguistic interaction among scientific subcultures as the process by which theorists, experimentalists and instrumentalists simplify their practice for presentation to the other subcultures (Galison, 1997).

Therefore, Galison's creolization is involved in the expanded integration that originates from the complex relationship among theory, experiment and instrument building in science. It can be applied to the integration between science and the other discipline, especially art (Galison & Jones, 2014). Galison's creolization might be a tool to effectively explain the process by which the encounter between science and art creates a new interdisciplinary field.

That is why creolization is actively utilized in the process of discussing bio art.

The Trading Zone as a Key of Creolization

Galison explains science using the plywood metaphor. The diversity and hybridity of science can make science more robust, just as plywood, which is made up of stacks of different laminated plates, is stronger than solid wood. It means that science is not weakened by the fact that there is no unified methodologies or principles. In this regard, he criticized both the logical positivism in the early 20th century and the antipositivism in the mid-20th century. That is because both of them wanted a single master narrative that can sustain the whole of science. Indeed, the logical positivists such as Rudolf Carnap argued that the unity of science is from the solid observational foundation (Carnap, 1963). The antipositivists such as Thomas Kuhn, on the other hand, argued that theoretical changes bring about all the scientific shifts with the totality and abruptness of a Gestalt switch (Kuhn, 1970). As Galison puts it, both models as flip-side versions of one another have a well-established hierarchy that brings unity to the process of scientific work (Galison, 1999). In other words, the logical positivism and antipositivism are each involved in the reduction to experience and the reduction to theory, but they share the assumption that the important experimental and theoretical breaks occur contemporaneously.

Galison discusses the logical positivism and antipositivism in terms of language. For both of them, language was the linchpin of science. The logical positivists sought to find a universal scientific methodology and a protocol language, as some linguists have searched for a unified grammar and a universal language that is the source of various languages. The antipositivists, on the other hand, said that scientific theories cannot be reduced to protocol languages, arguing that a shift from one paradigm to another is a radical change of incommensurability by the scientific revolution. However, Galison says that the potocol language of logical positivism and the incommensurability of antipositivism are hasty conclusions which give a one-sided impression of science (Galison, 1999). It means that the communication among different scientific subcultures is possible without a protocol language or under a different paradigm.

Here, Galison focuses on anthropological researches, in order to solve the problem of communication between heterogeneous scientific subcultures. It involves a trading zone that enables trade between two villages with different languages and cultures. He applies the concept of trading zone, which is a linguistic, practical and geographical space, to science. A trading zone formed among heterogeneous scientific subcultures is similar to that formed between two villages with different languages. Examples of trading zones include the MIT Rad Lab (Radiation Laboratory), which developed radar in collaboration with physicists and engineers during the Second World War, or formal and informal meetings of the National Accelerator Laboratory (later Fermilab), which consists of theoretical physicists, experimental physicists, and various engineers (Galison, 1999).

In a trading zone, two groups can hammer out a local coordination despite vast differences. It is related to pidginization and creolization. While the former is the process of creating a simple common language in which people from different cultures can communicate, the latter is the process of creating a full-fledged language with more complex vocabularies and grammars. As a result, a trading zone is a domain in which a simple contact language is first created and then a new constructed language emerges. The core competence of creolization is derived from a trading zone. Here, the anthropological picture is relevant to the way that theorists, experimenters, and engineers interact (Galison, 1999). Galison's examples such as the MIT Rad Lab or the National Accelerator Laboratory demonstrate that people from different scientific subcultures can hammer out a local coordination despite the differences in methodologies and standards of demonstration. In addition, the interactions among different scientific subcultures in a trading zone can lead to the creation of a new interdisciplinary field. That is why the trading zone is the domain where the local coordination among various disciplines takes place and a new interdisciplinary field emerges.

Trading between an Artist and a Bio Lab

Galison presented an interesting analysis of the relationship between science and art. If science is not related to a huge theoretical system but to an entanglement of theory, experiment, and instrument making, the boundary between science and art can be formed in various ways (Galison, 2014). Indeed, some new art forms in the twentieth century show various boundaries between science and art. New media art, including kinetic art, cybernetic art, system art, digital art, net art and so on, has expressed the boundaries between science and art through various technologies. Recently, some artists have enabled living creatures to become the aesthetic object or theme in their artworks by using biotechnology. Such attempts led to the birth of a new genre called bio art.

Artists such as Eduardo Kac, Joe Davis, Marta de Menezes and Anna Dumitriu have pioneered this new field of art. They have worked with living tissues, living organisms and life processes, using a variety of biotechnologies such as genetic engineering, tissue culture, and cloning (Pasko, 2007). New media artists mainly create their artworks using new media technology or digital technology in their own studios, but bio artists work in a life science laboratory. They approach to cutting edge researches in life sciences and apply the research outputs to their works. Therefore, the laboratory of life science becomes the studio of the bio artist. It means that the so-called bio lab can play a role as the place of the trading zone. In the place, artists and scientists exchange their views and knowledge, collaborate to produce new outcomes, and lead to interactions among different fields.

Above all, Kac demonstrates that bio art acts as a trading zone. His works show that bio art can be considered as a social and intellectual mortar that binds art and biology. For example, *GFP Bunny* (2000) and *Natural History of Enigma* (2009) show how artists and scientists trade predictions of transgenic outcomes. While the former is a transgenic rabbit injected with a GFP gene extracted from a jellyfish, the latter is a transgenic flower expressing an immune gene extracted from the blood of Kac into a red leaf vein of petunia. According to Kac, the transgenic rabbit is a chimerical animal capable of glowing with a bright green light (maximum emission at 509 nm) under a blue light (maximum excitation at 488 nm) (Kac, 2000), and the transgenic flower is a plantimal created by a protoplast fusion of plant cell and animal cell (Kac, 2003). Here, Kac predicts the existence of an individual with intuitive certainty. Creating his works, Kac feels certain that genetic modification can be transformed into a tool of art, and considers the process and procedure as a practice of art. Here, Kac predicts the existence of an individual with intuitive certainty. On the other hand, the scientists involved in Kac's works accept the prediction as something like an interesting hypothesis to develop the next version of their experiment. Although it is not easy for artists and scientists to coordinate their different positions, they can sometimes have a consensus within the creation process. It means that there exists a context within which artists and scientists can trade their different goals in the trading zone called bio art.

The Creation Process of Microbial Art and Creolization

Looking directly into the creation process of bio art provides a chance to reason what happens in the trading zone called bio art and how creolization proceeds in the interaction between an artist and a bio lab. The creation process of bio art by the textile designer and bio artist Siwon Lee is a good resource for such reasoning (Lee, 2017). She had the microbial art project called Apple project for 24 days starting April 14, 2016, and then has been working on the other microbial art project since September 6, 2017, in a laboratory in the Department of Microbiology at Dankook University in Korea. She kept the apples at room temperature, and then observed the fungi produced in the apples. The most commonly used apparatuses in the project are an optical microscope (IMT cam3PN: TP603100A Olympus CX41), agar plates with Dichloran Rose Bengal Chloramphenicol (DRBC) Agar Base, and incubator for cell culture. Figure 1 is the process of observing the fungi with a microscope in the laboratory, and figure 2 is the process of artificially culturing the fungi in an incubator. The artificially cultivated fungi in the incubator grow rapidly in a petri dish. As shown in figure 3, Lee arranged various patterns according to the life cycle of fungi. Then, as shown in figure 4, she transformed them into various images using a computer graphic program.

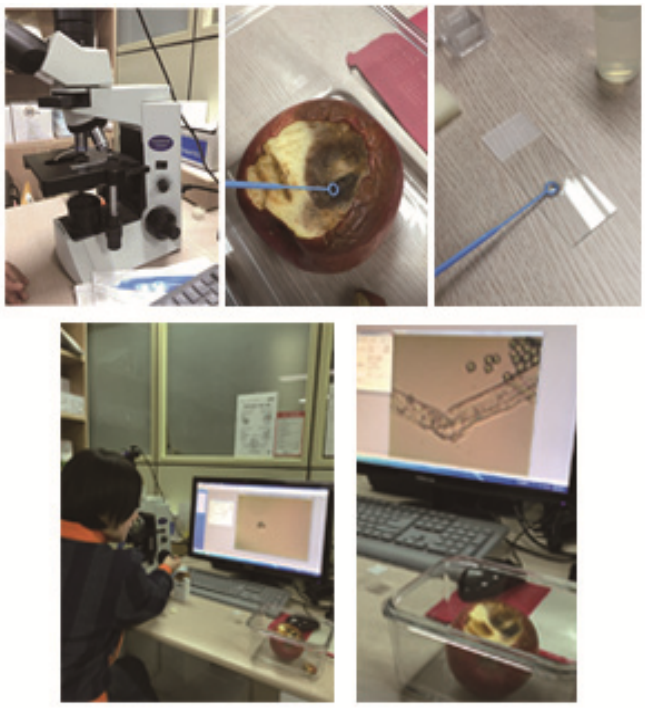

Figure 1. The process of observing the fungi in the laboratory © 2017 Siwon Lee.

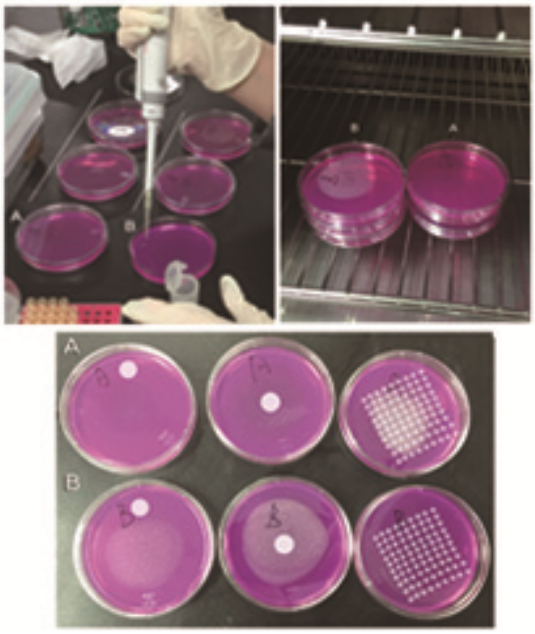

Figure 2. The process of artificially culturing the fungi in an incubator © 2017 Siwon Lee.

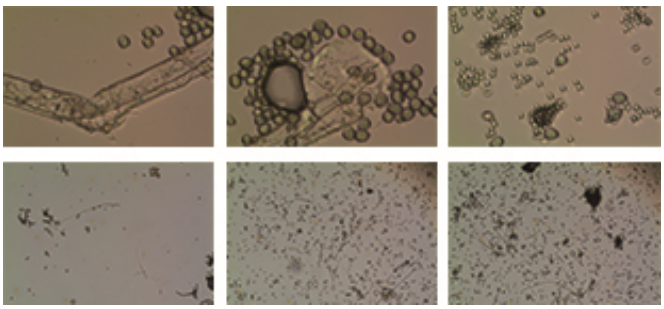

Figure 3. Siwon Lee, The various patterns according to the life cycle of fungi © 2017 Siwon Lee.

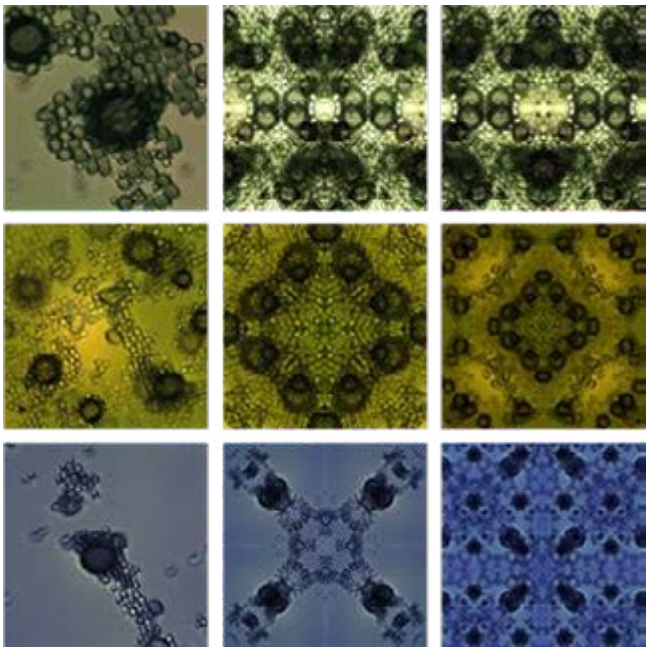

Figure 4. Siwon Lee, *Apple project*, The various fungi pattern images transformed by a computer graphics program © 2017 Siwon Lee.

Furthermore, she has grown the artificially cultivated fungi on fabrics. Figure 5 is images observed on cotton (left) and wool (right) after 5 days of fungus inoculation. In fact, scientists involved in the microbial art project have revealed their interest in this part. It becomes the context within which Lee and scientists can trade each goal. That is why it is the direct cause of trading between an artist and a bio lab in the project. Lee predicts meaningful results with intuitive confidence in the cultivation of fungi in fabrics. That is to say, she is convinced that the growth pattern of fungi can be transformed into a tool of art, and utilizes their growth processes as artistic outcomes. On the other hand, scientists accept the prediction as an interesting hypothesis to develop new experiments. Indeed, Jieun Kim, a scientist who has participated in the project with Lee, says: "It was a new attempt to observe the growth of fungi in the fabric. It is likely to be a meaningful experiment if we check whether the fungi are absorbing nutrients from the fabric itself. In the future, we will try to see if the fungi are growing even when the fabric is soaked only with distilled water, and we will check the growth pattern of the fungi in various environments including the fabric."

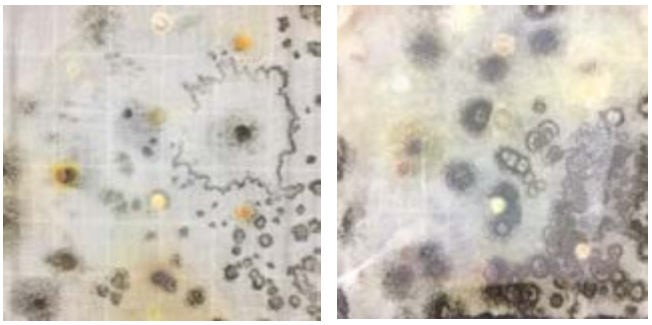

Figure 5. Siwon Lee, The images observed on cotton (left) and wool (right) after 5 days of fungus inoculation © 2017 Siwon Lee.

The fact that artists and scientists have a considerable consensus within the creation process does not necessarily mean that they should share the same goal and the same language. Just as the concept of trade does not presuppose the concept of universal currency, trading between artists and scientist does not rely on a universal language. It depends on whether artists and scientists have a shared context or not. In other words, within the trading zone called bio art, all artists and scientists need to do is to share a context within which they can trade their different goals. Even though they use the different terms or the same terms with different meanings, they can create their own language through a shared context. It means that creolization is taking place in bio art.

Just as learners with different linguistic backgrounds stabilize the simply mixed language called pidgin and contextualize the more complexly expanded language called creole, artists and scientists using different languages can experience creolization in their collaborative project. For example, as Lee says, artists and scientists use the term 'contamination' differently. Scientists in the laboratory think of contamination as a very serious risk, because it becomes a failure factor of the experiment that makes it impossible to identify various microorganisms. Artists, on the other hand, view contamination as a chance to create mixed media formed by a mixture of new materials, because it is involved in their imagination that the intervention of various microbial species is like a mixture of new materials. Such a difference made communication between Lee and Kim difficult at first. However, as the collaborative project progresses, they become able to understand that the term can be used differently from what they originally thought to be. In the situation where only one type of microorganism needs to be separated from other types, contamination should be avoided. On the other hand, in the situation of experimenting acceptance capacity of a new environment such as fabric, contamination can be a phenomenon that can be exploited. Thus, in the microbial art project, both the artist and the bio lab experience a kind of

creolization coordinating the different terms or the same terms with different meanings.

Conclusion

A few years before Kac first used the term 'bio art', all nucleotide sequences of Heamophilus influenza bacterial genome were published. This is evaluated as a new milestone in the history of science. After that, the genome sequencing of hundreds of prokaryotes and dozens of eukaryotes has been completed. Of course, it includes a human genome with 3 billion nucleotide sequences (Campbell, 2008). The results imply that biology has become one of the most notable areas for the future of mankind. It is derived from the development of biotechnologies such as genetic engineering and cellular engineering as well as biological subcultures such as molecular biology and genetics. Above all, the development of biotechnology has opened up the possibility of active intervention in life phenomena beyond observation of life phenomena. In fact, artists using biotechnology challenge such possibilities. Thus, the places in which bio artists work are related to both artists' studios and scientists' laboratories.

Interestingly, from the perspective of the trader described by Galison, such attitudes of bio artists are not different from that of Einstein who changed the notion of time and space, or Feynman who opened a new chapter in quantum electrodynamics. Galison says that theorists and experimenters are traders who coordinate the research parts of interpreted systems, not miraculous instantaneous translators (Galison, 1999). The theory of special relativity is linked to Einstein's experience in dealing with technology patents on clock synchronization in the Swiss patent office, and the Feynman diagram is involved in Feynman's experience in developing atomic bombs at Los Alamos. It means that science has not been developed as a simple theoretical system, but has been developed by a lot of trading between theories and experiments. In that sense, artists who are willing to enter the laboratory of science are traders who are encouraging a practical interaction between art and science.

Furthermore, they predict that there exists emergent evolution at the boundaries between art and biology. While scientists generally try to obtain more definite results in controlled experiments, artists try to get extended outputs by connecting objects with external environments. Such different views sometimes cause conflicts between artists and biologists. But when they cannot find proper answers for themselves, sometimes the different views might provide useful solutions each other and contribute to a healthier growth of our societies (Malina, Topete, & Silveira, 2017). Thus, bio art can be a trading zone that leads to trading activities between artists and scientists. Actually, as we saw in the collaboration of Kac and some scientists, in the trading zone called bio art, artists and scientists can trade their goals assuming a shared context.

As a result, the creation process of bio art shows the creolization that occurs within the trading zone. Even though artists and scientists use different languages in the trading zone called bio art, they create their shared language through a shared context. As we saw in the final chapter, Lee's Apple project is under creolization. In the ongoing project related to microbial art, both the artist and the bio lab experience creolization coordinating their different languages. It means that a new interdisciplinary field called bio art is a creolized art form of art and biology.

References

Burke, Peter. (2009). *Cultural hybridity*. Cambridge: Polity.

Campbell, Neil A. and Reece, Jane B. (2008). *Biology,* 8th ed. San Francisco: Benjamin Cumming's Publishing Company.

Carnap, Rudolf. and Schilpp, P. A. (1963). *The Philosophy of Rudolf Carnap*. Cambridge: Cambridge University Press.

Galison, Peter. (1997). *Image and logic: A material culture of microphysics*. Chicago: University of Chicago Press.

Galison, Peter. (1999). Trading zone: Coordinating action and belief, in Mario Biagioli (ed.) *The science studies reader*. New York: Routledge.

Galison, Peter. and Jones, Caroline A. (2014). *Picturing science, producing art*. New York: Routledge.

Hannerz, Ulf. (1987). The world in creolisation. *Africa*, *57*(4), 546-559.

Kuhn, Thomas. *The Structure of Scientific Revolutions*, 2nd ed. Chicago: University of Chicago Press.

Kac, Eduardo. (2000). *GFP Bunny*, Retrieved from http://www.ekac.org/gfpbunny.html#gfpbunnyanchor

Kac, Eduardo. (2003). *Natural History of the Enigma*, Retrieved from http://www.ekac.org/nat.hist.enig.html

Lapierre, Nicole. (2004). *Pensons ailleurs*. Paris: Stock.

Lee, Siwon. (2017). *Apple project*. Retrieved from https://www.instagram.com/2siwonz

Malina, R. F., Topete, A. G., & Silveira, J. (2017). What Is the Evidence that Art-Science-Technology Collaboration Is a Good Thing?. *Leonardo*.

Muysken, Pieter. and Smith, Norval. (1995). The study of pidgin and creole languages. *Pidgins and creoles: An introduction*, 3-14.

Pasko, Jessica. (2007). *Bio-artists use science to create art*. Retrieved from http://usatoday30.usatoday.com/tech/science/ethics/2007-03-05-bio-art_N.htm

Romero, J. L., & Romero, L. A. (1976). *Latinoamérica: las ciudades y las ideas*. México, Madrid and Buenos Aires: Siglo veintiuno editores.

Awkward Consequence

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Abstract

This paper presents Awkward Consequence, a massive virtual reality performance that explores and expands the limits of audio-visual performances, offering alternative paths of exploration of the aesthetics of virtual reality. Using mobile phones and cardboard–like viewers, together with a centrally–controlled architecture, Awkward Consequence immerses its audience in a virtual journey that is simultaneously individual and shared. By joining the rich tradition of musical performance with virtual reality, the piece investigates the future role of virtual reality, while simultaneously celebrating the immense artistic richness of this new medium.

Keywords

Virtual Reality, Computer Music, Performance, Concert, Network, Mobile Phone.

Introduction

"Reality is becoming a stereo-reality. Just as with sounds you can make a difference between somber tones and clear tones, so there will be a concrete, actual reality and a virtual reality. From now on, humankind will have to act in two worlds at once. This opens up extraordinary possibilities, but at the same time we face the test of a tearing-up of the being, with awkward consequences." Paul Virilio [1].

In this paper, we present Awkward Consequence (AC), a massive virtual reality performance that explores and expands the limits of audio-visual performances, offering alternative paths of exploration of the aesthetics of virtual reality.

AC consists of a musical performance where the audience is immersed in a music–driven virtual reality journey, where the music (composed for the performance) is performed in–situ by the artists. The performance, therefore, exists in what Virilio calls a stereo-reality, simultaneously unfolding as actual and virtual experiences, with each one allowing for different and complementary aesthetic explorations.

This coexistence in two different, often antagonistic, realities is central to the piece: with AC—like in traditional concerts—the experience is co–created by the simultaneous perception of the same stimuli by the audience. However, here the work is perceived from an immersive, isolated experience. The journey through the virtual reality (VR) worlds is a private, personal experience, where the spectator is completely alone. However, the spectator knows that the individual experience is simultaneously experienced by all the attendees. An individual, yet shared experience.

In this duplication of reality, a new aesthetic experience emerges. New media art often requires making certain characteristics explicit, to allow the creation of new artistic languages. For example, although every artwork can be thought of as interactive [2], only with the creation of explicit interactive works, the *art of interaction* could begin to be explored.

AC not only explores the aesthetics of VR, but also makes explicit—and questions—some of the characteristics of public performances.

The piece was performed twice in Hong Kong in May of 2016. AC uses cardboard viewers and the attendees own mobile phones running our software. The first performance was hosted by ISEA 2016 [3], and the second was hosted by K11 [4].

Virtual narrative

"I wanted my body back" Myron Krueger, 1991 [5]

The recent increase in interest in Virtual Reality together with the popularisation of relatively affordable related technologies, have created a space of interest where companies and organisations fight for influence over this medium [6]. This influence should not be seen only in terms of market share, but also in terms of the definition of what the medium of VR is, what its aesthetic parameters and role within society are. Its "terms of usage and content" are being defined by the dominant forces in the industry [7].

The discussion of the implications of VR both in industry and academy tends to obviate this social and political dimension focusing instead on a "device-driven" definition of VR, that "fails to provide a conceptual framework", and fails to provide methods for consumers to understand "the nature of virtual reality" [8].

Is in this context, we created a performance where the political dimension is present both in the insertion of an original aesthetic as well as in the explicit impact on the experience of the performance's audience. AC's aesthetic builds on the traditional graphic language of VR moving towards unchartered territories, questioning and systematically negating the basics parameters of this nascent language.

AC orchestration of the perceptual experience of the attendees showcases the narrative and behavioural power of

VR. By requiring the audience to surrender and immerse themselves in the performance's space, the asymmetries in power inherent to any massive medium in general, and to VR in particular, are revealed. The artwork is constructed from the exploration of the aesthetics of this relationship.
Designing a VR experience implies creating a world and situating an observer in it. Camera–placement and world creation are, however, not new, for there are long cinematographic and theatrical traditions available. This generates a tendency to think of VR in relation to these previous practices, where the Platonic categories of "Diegesis" (directly addressing the audience), and "Mimesis", (addressing the audience through characters) are directly applicable [9].
VR, however, is able to escape the diegetic–mimetic dichotomy; artists are not verbally narrating, nor they are (only) deploying characters. Instead, a VR poet offers a computationally–backed meta–narrative. The narrative becomes implicit and emerges from the interaction between the participants and the virtual world behavioural and perceptual rules.
In AC we designed a sequence of worlds that starts offering an understandable environment to the audience, and then explicitly negates some aspects of the metaphorical world. The narrative unfolds then as a meta–narrative, inhabiting a meta–world that emerges from this aesthetic questioning of the environment's design.
If, as Bordwell states, "perspective is narrative" [10], AC's meta–narrative inhabits the construction of these autocratic scene–worlds, allowing the audience to reflect on the meta–aesthetics of the experience: an artwork that exists in the artistic discussion of its own medium.
"Perspective as narrative" refers not only to the technical ability needed for VR's trump l'oeil, but also to the narrative that emerges from the shared technological knowledge between artist and audience.
If "to see something as art requires something the eye cannot descry – an atmosphere of artistic theory, a knowledge of the history of art: an artworld" [11], new media art also requires a techno–world, where the consumption of the technological object is complemented with an understanding (by both audience and creator) of its environment and social roles.

If being an artist requires questioning the nature of art [12], technologically mediated artistic production also requires challenging what technology is, what its social roles and possibilities are.

Image as stage, place as narrative

AC's experience consists of a fifteen minutes' journey throw a series of related scenes. As the performance plays, both in the actuality of the music played by the artists as well as in the reactive synchronisation of visuals and sound, we can explore a new reality that expands the idea on virtual scenography [13]. However, in difference to early speculations on the idea of the augmentation of a performer via projection mapping or reactive visuals, as discussed by Jacquemin and Gagneré [14], AC augments the perception of the participant, expanding the limits of what is cognoscible and what is perceptible within the fictional universe.
The virtual environment is reactive and augmented—a stage without actors—suggesting a possible reversal of the actor/spectator relationship. Again: perspective is narrative, opening the possibility to enhance the theatrical where, "as a consequence, architectural forms built in cyberspace can respond to the viewer, encouraging provocative and illuminating interactions. In cyberspace, architecture becomes a form of poetry" [15].
The total immersion of virtual reality, draws us closer to the total art, the *Gesamtkunstwerk* and its relation between media throughout the past centuries. Predating Richard Wagner's articulation [16], the Rococo, in the 18th century also created exuberant, anarchic forms and wild ornaments (Figure 1). Notably, due to the technical ability to materialise the complexity designed by the artist being insufficient at the time, the most exuberantly designed elements can be found in the ornament prints of that time.
With conscious disregard of formal alignment and rules of constructed perspective, the *capriccios*, printed and distributed as an early form of advertisement, showed the possibilities of the Rococo (Figure 2), where the wilderness merges, and the foreground is distorted, blending with

the middle ground of the pictorial plane. Perspective as narrative.

Figure 1. Johann Michael Fischer, German architect of the interior works and integration of stucco and painting at the Abbey of Ottobeuren (1744). Photo Johannes Böckh & Thomas Mirtsch.

Grau, Punt, and Asberry [17], see this mixed–reality space as a "faux terrain", a space that exist simultaneously as a physical reality, and as a virtual quality of a perspectival constructed image plane.

Our work proposes a related discourse: the actual sound of the performance drives the behaviours in the virtual world. The audience is presented with a real object and a virtual causal relation, and this unfolding guides the journey

Figure 2. Johan Esaias Nilson, "Natura miracula" ca. 1770. The etching shows the confluence between natural and ornamental artefact, embedded in a continuum blending frame, foreground and middle ground. (© Museum of Applied Arts_MAK, Vienna).

Choreography as performance

AC exits in contradiction, a virtual journey and a physical static attendance.

The initial virtual scene consists of a wireframe landscape, fully reactive to the music and environmental sound. The scene, titled *The landscape* (Figure 3), adopts an early virtual reality aesthetic, reminiscent of cinematic experiments—such as the rendered wireframe surface of the film *Tron* (Steven Lisberger, 1982), or the contour map of a planet's surface in *Alien* (Ridley Scott, 1979)—where the audience already knows the metaphorical world representation.

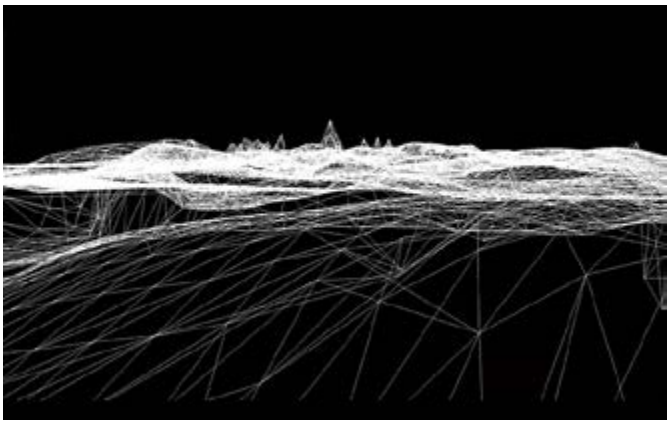

Figure 3. Rendering of the opening sequence of Awkward Consequence. (© authors)

The following scene presents a shift from the static camera position of the participant to a directional linear movement. *The tunnel* (figure 4), resembles a slow linear movement, reminiscent of the movie *2001: A Space Odyssey* (Stanley Kubrick, 1968). Reframing Kubrick's frequent symmetrical arrangements, this second stage is symmetric and closely reassembles the final scene of time and space. Also similar to Kubrick's usage of early CGI effects to illustrate a passing of time, this scene uses illuminated platonic geometric elements that gradually increase in complexity through aggregation.

Figure 4. Rendering of the second sequential movement of Awkward Consequence. The Tunnel introduces a linear movement to the Virtual Reality performance (© authors).

The first two scenes allowed a certain degree of openness. *The landscape*' sky is black and empty, *The tunnel* allowed to look back creating a sensation of spatial and temporal continuity.

What follows is the first pre-rendered scene. *The room* (Figure 5), a closed, pulsating, and rotating environment where up or down, left or right lose relevance. No horizon is visible. Instead, the space is defined by a complex ornamentation and the dissolving of structured space and wireframe contours. The journey has arrived in a manmade environment, crafted with ornaments, reminiscent of gothic architecture.

Figure 5. Rendering of the third movement of Awkward Consequence. The Room is a fully closed environment. The participant has no horizon; landmark or similar known orientation help and is immersed in the performance. (© authors)

Reacting to a sudden change in the music, the journey is abruptly interrupted by digitally intervened bi–dimensional footage of Hong Kong (Figure 6). After losing a frame of reference in *The room*, here the ultimate treason of VR is

fulfilled: all illusion of three-dimensionality is discarded, the audience loses the control of the point-of-view and is rendered immobile, taken into a figurative trip through the city. Contradiction arises anew: the footage moves through a city were the actual audience is still.
Although AC is not thought of as a location–specific artwork. The performances in Hong Kong (2016), allowed for this reflection of the role that place plays in human realm. What does it mean to *be* somewhere?
The already–present dichotomies between performance and world, shared and individual experiences are here maximised. A climax of hyper–real bi–dimensional representation operates as a negation of the stereo reality, of both the virtual and actual worlds. Representation becomes figurative and abstract. AC reminds the audience that the construction of place is always arbitrary, places don't exist until we grant them existence. Place is narrative.

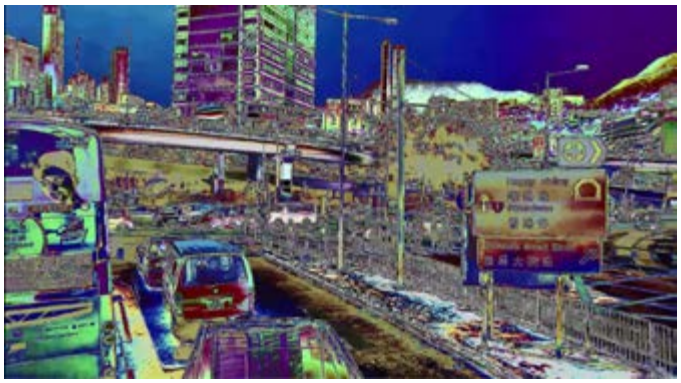

Figure 6. All footage is filmed in Hong Kong. The participant is confronted with the location clash of his/her position in Hong Kong in a VR environment. Even more so, the 2D real film footage is questioning the otherwise iteratively intensify visual narration. (© authors)

From this point, in reverse order and with significant alterations, AC retraces the constructs visited. From *The room*, through *The tunnel*, the participant arrives at a new open landscape. *The sea* (Figure 7) is the second and last pre–rendered space. An unapologetic abstract hyperrealism that celebrates the possibilities of the medium, while reminding us of its inherent strangeness. With a duration of three minutes, it shows a waving sea, materialised as a thick wireframe carpet of colliding geometries.
Formally quoting Sugimoto Hiroshi's cycle of seascapes [18], a blend between the sky and sea into an almost whiteout space that retains the spatial qualities, is fundamental in the design of the environment. Yet, where Sugimoto inspires calmness, *The sea* also references works of Peter Schlör: disturbing, wild, and contrasted photography [19]. These two artists provide the formal framework for the environment.
The sea is also the only scene with other inhabitants: abstract creatures that ignore the audience, drifting in the dark environment. Peaceful, yet distant. Alive, yet alien. Actors yet scenography. A metaphorical representation of a stereo reality from within.

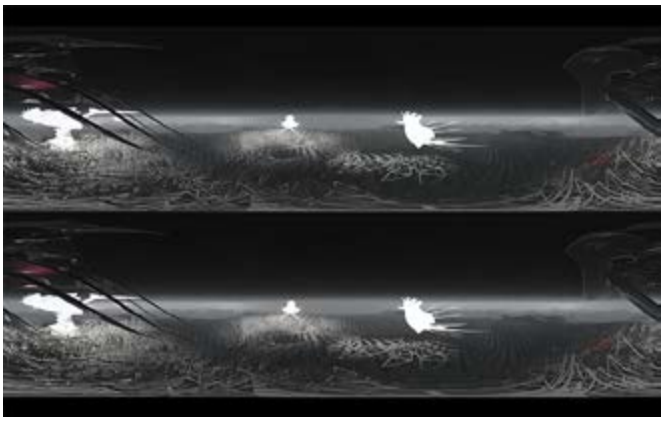

Figure 7. Raw data before being mapped in Unity 3D to two spherical environments. 360 spherical renderings of the sea environment upper and lower mapping. (© authors)

Awkward Consequence

The development of AC's hardware and software infrastructure faced several technical complexities, particularly regarding the integration of known solutions in a computationally heterogeneous environment.
A client–server architecture was adopted, with client–hosted data. Clients were implemented using Unity3D 5.4 [20], together with Google's Cardboard SDK [21].
Unity3D's straightforward asset pipeline and importing tools greatly streamlined the development process.
To provide a consistent visual experience, our tests shows that a minimum of 60 FPS was necessary. The following rules allowed us to achieve it in the heterogeneous computing park of AC:
a. Not using full frame shaders.
b. Never rendering more than 16.000 vertices (this required simpler 3D models, and to load and unload geometry in execution time).
c. Only using triangles as primitives (mobile graphics chipsets are optimized for triangles).
d. Using a maximum of three light sources per scene.
e. Preferring alpha blending and baked lighting over new light sources.
f. Using small textures, and texture atlases (AC uses a max texture size of 1024 by 1024 RGBA pixels).
Given the substantially different processing power and rendering capabilities of the audience's phones, to ensure the required framerate, the two most complex scenes—mostly in the form of high polygon count, complex lighting and material properties requiring—were pre–rendered and played as stereoscopic 360 videos (Figure 8).
To reproduce these videos, we used a third-party video player solution [22] that allowed using Android's and iOS's native video players (Unity3D's native video player has serious performance limitations), offering the video to Unity3D as a new equirectangular texture that was mapped onto inward pointing spheres surrounding each eye (Figure 8).

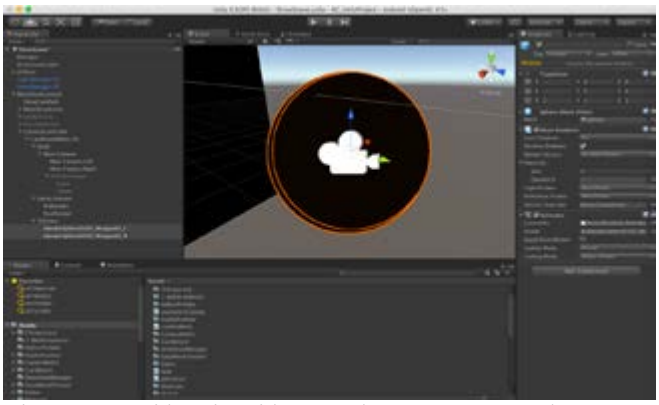

Figure 8 3D video rig with two spheres - one on each camera, creating a parallax effect (© authors)

Bi–dimensional video only required a fixed frustum aligned with the user's point of view (Figure 9).
To achieve smooth video reproduction, the combination of codec and resolution depicted in Table 1 was followed.

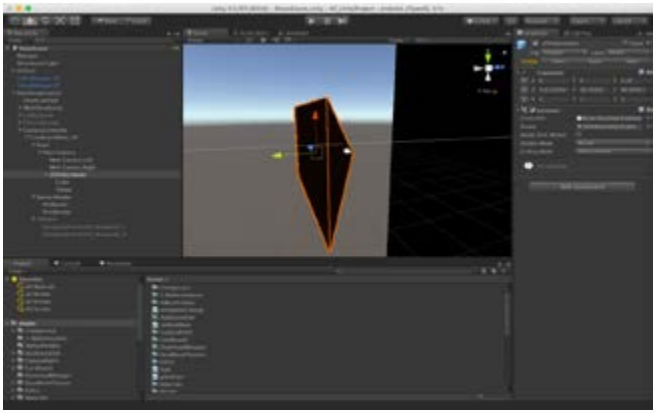

Figure 9 2D video rig - a single frustum aligned with the main cameras using Unity3D. (© authors)

All video content was stored as a single file that was reproduced following AC's script. This video weights 1.2 Gb making it impossible to store it within the application. A custom Unity3D plugin was implemented that reliably downloaded the video from an Amazon S3 server [23].

OS	Codec	Resolution	FPS	Avg. Bit Rate
Android	h.264 (Baseline, level 4.2)	1920 x 1080 (3840 x 2160 on high end devices)	30	20-30 Mbps
iOS	h.264 (Baseline, level 3.1)	1920×1080	30	10-14 Mbps

Table 1 – Codec and resolution criteria for video files used in Awkward Consequence.

Wireless synchronisation between the server and all the clients was implemented using OSC messages over UDP in a WLAN. Within this architecture, the server coordinated the show. It emitted a periodic (heartbeat) message and controlled specific real–time parameters sending orders to all the connected clients.
Given that IP broadcasting was unavailable due to mobile phones ignoring broadcast messages to save power, AC implements a unicast broadcast–by–subscription protocol, where one component [24] acts as a client register and message relay.

Epilogue

Robert Barker patented the panorama in 1789. In effect, for several centuries, "extraordinary efforts were made to produce maximum illusion with the technical means at hand" [25].
The contested space of contemporary virtual reality, however, for the first time presents a problem that is much less technological than artistic and socio–political. The reasons behind massive adoption depend not on the ability to render convincing illusions, but on the economic and social role that the VR as a medium will play.
In this context, there is an urgent need for artistic exploration of this new medium. Awkward Consequence aims at generating some space for this exploration: via the creation of a compelling aesthetic experience, we propose that the search for alternative paths is not only urgent but also attainable.
Even if it's true that new media art is always somewhat subversive—it systematically attempts to escape from the role of passive consumer—virtual reality art has not been able to reach a significant audience.
By joining the rich tradition of musical performance with VR, our work generated spaces of reflexion, while simultaneously celebrating the immense artistic richness of this new medium.

Acknowledgments

Awkward Consequence was possible thanks to the generous help of our sponsors and collaborators: K11, Microwave, Videotage, School of Creative Media, ISEA2016, Tatjana Kudinova, Alex Tobler and Federico Linn.

References

[1] Oliveira, C. (1996). Global Algorithm 1.7: The Silence of the Lambs: Paul Virilio in Conversation. Journal

CTheory. Retrieved from http://journals.uvic.ca/index.php/ctheory/article/view/14317/5093
[2] Duchamp, M. (1957). The Creative Act.
[3] ISEA 2016. Conference's webpage: http://isea2016.isea-international.org/
[4] K11. Company's webpage: http://hk.k11.com/
[5] Krueger, M. W. (1991). What Should You Wear to an Artificial Reality? Proceedings from International Conference on Artificial Reality and Telexistence, Tokyo, Japan.
[6] Ecenbarger, C. (2015). Are we still in the game? Constructing consumer virtual reality through the lens of artist and industry. Master of Arts. Ball State University, Muncie, Indiana.
[7] Law, J. (1991). A sociology of monsters: Essays on power, technology and domination. 171. Retrieved from http://library.wur.nl/WebQuery/clc/1900885
[8] Steuer, J. (1992). Defining virtual reality: Dimensions determining telepresence. Journal of communication, 42(4), 73-93. doi:10.1111/j.1460-2466.1992.tb00812.x
[9] Aylett, R., & Louchart, S. (2003). Towards a narrative theory of virtual reality. Virtual Reality, 7(1), 2-9. Retrieved from http://link.springer.com/article/10.1007/s10055-003-0114-9
[10] Bordwell, D. (2013). Narration in the fiction film. Retrieved from http://www.hi.zpok.hu/filmtext/Egyeb/Bordwell-Mimetic.pdf
[11] Hernsberger, E. (2006). Photography as readymade art. Texas Tech University, South Plains.
[12] Kosuth, J., Guercio, G., and Lyotard, J.-F. 1991 Art after philosophy and after: collected writings, 1966-1990. Mit Press Cambridge, Mass.
[13] M. Reaney, "Virtual reality and the theatre: immersion in virtual worlds". Digital Creativity, 10(3), pp.183-188. (1999)
[14] C. Jacquemin, and G. Gagneré (2007), "Revisiting the layer/mask paradigm for augmented scenery". International Journal of Performance Arts and Digital Media, 2(3), pp.237-257.
[15] Ken Jordan, Randall Packer Ph.D. (2001), "Multimedia: From Wagner to Virtual Reality".
[16] R. Wagner (1849), 'The Art-work of the Future'.
[17] O. Grau, M. Punt, and K.R. Asberry (1999), The Panorama: History of a Mass Medium by Stephan Oettermann (review). Leonardo, 32(2), pp.143-144.
[18] H. Sugimoto (1988). Photographs by Hiroshi Sugimoto: Dioramas, Theaters, Seascapes. New York/Tokyo/Kyoto: Sonn/abend Gallery & Sagacho Exhibit Space.
[19] P. Schlorr (2012), Black & Wide. Gosling Nabakowski. Städtische Galerie Neunkirchen.
[20] Unity 3D. Company's webpage: https://unity3d.com/
[21] Google Cardboard. Product's webpage: https://vr.google.com/cardboard/
[22] Easy Movie Texture. Unity Plugin. Asset store url: https://www.assetstore.unity3d.com/en/#!/content/10032
[23] Unity Mobile Downloader. Git repository url: https://github.com/tenderbolton/AWK_UnityMobileDownload[24] AWK_Comm component. Git repository url: https://github.com/tenderbolton/AWK_Comm
[25] O. Grau (2002), Virtual Art, from illusion to immersion. pp. 5 ISBN: 9780262072410
[26] K11. Company's webpage: http://hk.k11.com/
[27] Microwave. Festival's webpage: http://www.microwavefest.net/festival2016/
[28] Videotape. Organization's webpage: http://videotage.org.hk/web/
[29] School of Creative Media. School's webpage: http://www.cityu.edu.hk/scm/
[30] ISEA 2016. Conference's webpage: http://isea2016.isea-international.org/
[31] Tatjana Kudinova. Artist's webpage: http://tkudinova.com/

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Sustaining Cultural Heritage through Digital Preservation

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Abstract

We are on the brink of losing many cultural heritage sites around the world. Man-made and natural disasters have played a contributing role in these destructions. Museums, libraries, archives and other private and public institutions across the world have undertaken the tasks of preservation and conservation. The preservation progress is tremendous but also limited. The preservation of cultural heritage requires extensive collaboration within the community in defining accuracy and authenticity of historical information. It needs establishing cultural knowledge, what it entails, and how the community might best contribute. It demands scholars to establish preservation practices that are deeply ingrained in the cultural activities. This paper is an attempt to use the traditional and emerging technologies in digital preservation of a cultural heritage site in the Kathmandu, Nepal which was destroyed in the April 2015 earthquake. Working with a local community in Nepal, overcoming preservation challenges and visualizing of three-dimensional prototypes in a virtual reality environment, this paper explores in bridging the gap between the documentation and preservation practices.

Keywords

Cultural Heritage, Digital Preservation, Virtual Reality, 3D Visualization, Prototyping, Human-Computer Interaction

Introduction

Much of the cultural content in recent history is documented through scanning and modeling while traditionally it was documented through drawings, manuscripts, and photo imaging. This type of documentation has affected history and time through interpretation and cultural awareness. The use of digital technology such as virtual reality in archeology and preservation of historical artifacts seems like a tangible path. Digitally constructing in preserving cultural heritage can be challenging and daunting. Methods of preservation, cost and metadata and archiving techniques [1] need careful analysis for historical accuracy, authenticity and cultural awareness. Bridging the gap between documentation and preservation need to be evaluated and examined thoroughly [8]. Thus, modern science and digital technology have become an ideal choice for many tasks of preservation.

Preserving of a cultural heritage is stimulating but can be challenging and overwhelming. Rebuilding and reconstructing of destroyed historical sites can be perplexingly complex, yet sometimes logistically and financially impossible. Institutions across the globe such as, National Archives have created various national and international initiatives to preserve much of the historical contents. But, they are limited to traditional preservation materials in paper-based, microforms, photographs and audio-visual formats [2,3,4].

To address the ongoing issues in preserving of cultural heritage sites, the UNESCO convention in 2013, brought together 160 countries around the world that agreed to safeguard the "Intangible Cultural Heritage" around the world. The UNESCO maintains the registry lists of "Good Safeguarding Practices" that allows communities and other stakeholders to share successful safeguarding experiences, examples and challenges in preserving their living heritage [5]. In recent years, the Smithsonian National Museum in the United States has started utilizing three-dimensional digitization and replication technologies such as photogrammetry and rapid-prototyping. Although plentiful efforts have been placed into digitizing cultural heritage, the process has been slow and expensive [6]. In many cases, access to preservation sites faces substantial challenges and difficulties. Thus, preservation in digital humanities is encouraging, yet largely experimental and still untested [6, 7]. Various tools and methodologies are used in documenting manuscripts, books and physical historical resources; the decay of those materials is rapid and real [6]. Efforts in addressing these issues must be seriously considered and discussed.

In recent years, the extraordinary development of digital interactive technologies such as virtual reality, augmented reality and mixed-media reality offer an ideal platform to synthesize the ongoing preservation challenges. Historical inaccuracies are easier to identify and authenticate into a reliable information/ technology that has the potential to unleash innovation and discoveries. This paper shares an ongoing development of a virtual reality

project that uses innovative and creative solutions for documenting and digitally preserving a physical cultural heritage site. The study has provided optimistic results that may contribute to sustaining a cultural and historical artifact in the future. The technology used in this development has offered an opportunity to understand user-interaction and frameworks for trans-disciplinary studies in a virtual reality environment. In the future, these results may offer us insights in accessing complex visual processing and scientific visualization as well as help us gather historical information efficiently and effectively. Finding innovative solutions in archiving, documenting and preserving through these type of development and studies will allow us to understand the user preferences in accessing historical archives and ease of use of a new technology.

Historical Significance

As part of an ongoing effort of reconstruction and rebuilding after the April 2015 earthquake, preservation groups and academic institutions have been working tirelessly to preserve the cultural heritage sites in Nepal. Bungamati, which is known as "*Rato Machendranath*" temple, dates back to 6th century A.D. [16,] (Figure 1). At the , Lab (For more information see, http://www.ubalt.edu/gamelab), we used archival footage and historical manuscripts of the physical environment of the "*Bungamati*" temple and surrounding areas into the development of the three-dimensional models. It was later implemented into a virtual reality technology. Preservation of this size is challenging. We worked with our global partners between the United States and Nepal. Students and faculty at the Kathmandu University and the University of Baltimore including, the local community in Bungamati area and local government officials in Nepal were involved in the past two years of this development.

Despite the richness and complexity of the proposed project. The collection of this nature could hold a significant and noble resource for the study of historical artifacts and cultural heritage for people around the world. Although there are archival procedures in place, minimal effort has been set to document and to collect the historical information in recent years. Nepal's current economy and continuing political crisis are the two major factors that prevent these cultural heritage sites to be archived. The proposed solution of digitally preserving a cultural heritage is an ideal solution that can be accomplished with minimal disturbance to the ancient archeological sites. Alternatively, visualizing cultural heritage sites in a virtual reality may become a platform to rebuild and restructure the destroyed architecture and artifacts in the near future.

Figure 1: The historic area of Bungamati (Rato Machendranath) – before and after April 2015 Earthquake. (Photo credit: left Mauro/Ornella, right Omar Havana)

Literature Review

Preservation of cultural heritage are aimed in preserving tangible as well as intangible heritage [12]. The use of economically sustainable and reasonable solutions of accomplishing the up keeping of the cultural heritage and historical artifacts without minimal disturbance has become a challenging issue in the preservation and conservation [12, 9]. The use of virtual reality and new digital technology like a rational path, but constructing and preserving cultural and historical artifacts is challenging. Preservation methods and archiving techniques need careful analysis. Technologies such as the CAVE automatic virtual reality environment, head-mounted display (HMD) and mixed-reality technology has the potential to unleash new innovations and discoveries in preservation related tasks [13]. They can become a meaningful tool in the scientific community. It provides an opportunity for engaging users in an immersive and interactive historical environment while achieving the technological opportunities of making interactive history. So many confounding factors plays a role in designing and replications of historical artifacts, these types of research need long-term planning, an understanding of documentation and preservation process [8] thus, maintaining of the digital historical artifacts by working with the scholars, community and National Archives [10] around the world.

Methods

In the research study, we used two types of virtual reality technology; (a) CAVE automatic virtual environment and (b) HTC Vive head mounted display (HMD). The virtual environment of the cultural

heritage site "Bungamati" was developed at a research lab at a public university in the United States. The lab is equipped with immersive, visualization and interactive game technologies, and used as a hub for interdisciplinary study in games and media.

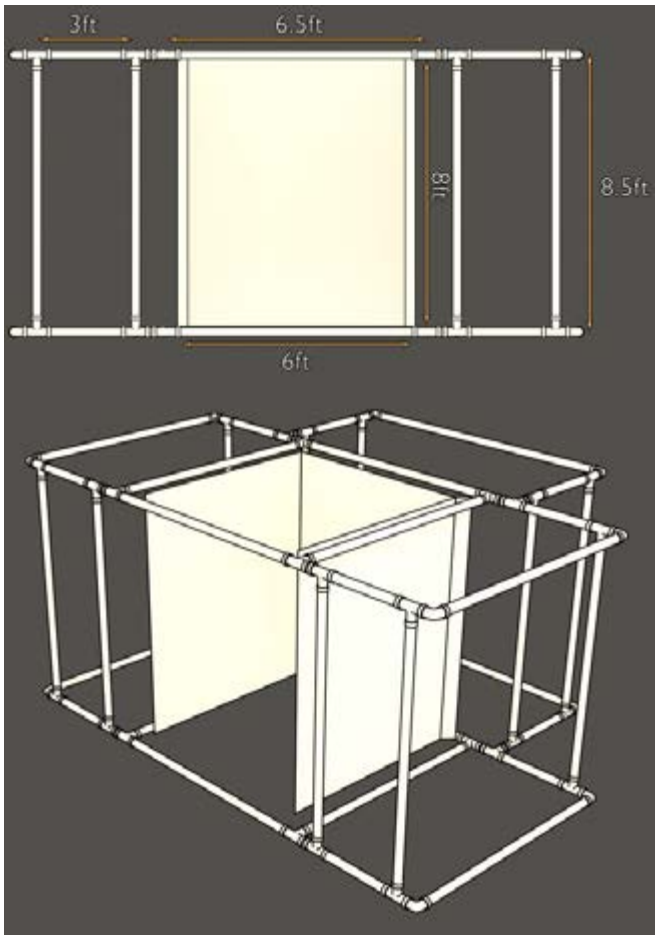

Figure 2: The schematic view of the CAVE virtual reality system.

The U-Shaped CAVE virtual reality system was designed and constructed. Inspired by various types of display technologies and CAVE design – particularly superior in field-of-view and visual acuity [14] – we used modular walls and low-cost hardware electronics (Figure 2). The system relies on a multi-projection positioning system to achieve 3D stereoscopic viewer-centered perspective, synchronized with an active shutter glass. The active shutter glass converts the 2D images generated by the projectors into a three-dimensional stereoscopic display. To accomplish interactivity, haptic devices such as Xbox 360 and PS3 wireless game controllers were interfaced with a host workstation. The controllers were used as tracking devices for navigation and user position. To prove the projection ability and visualization technology and to achieve virtual reality (VR) research goals, students at the Lab worked with various types of construction materials. PVC pipes were used to design the modular CAVE structure (Figure 2). Shower curtains were fabricated into a rear-projection stereoscopic display. The display screen was created in 8 ft. by 6 ft. three-faced walls with six 3D rear short throw projectors. Each 3D projector had maximum 5000 lumens with the 1080p high-definition (HD) display with 70 Hz of refresh rate with projected surface area of 4 ft. by 3 ft. Various software was used such as, Autodesk 3D Studio Max. Texture maps were developed using photo editing software Adobe Photoshop. The final 3D models were exported into the Unity3D game engine. Programming language C# and JavaScript were used and a wireless Xbox 360 controller was used as a haptic device to interact with the CAVE environment.

Figure 3: A user interacting with a virtual "Bungamati" area (see Figure 1) in a CAVE automatic virtual reality environment.

The first study compared user preferences of finding color/ patterns, shapes, usefulness of VR and search for historical information including general ease of use between two mediums, (setup 1) CAVE automatic virtual reality environment and (setup 2) paper-based artifacts. 14 student participants volunteered for this study. Institutional Review Board (IRB) permission was approved at a major university in the United States to carry out this study. Each participant filled out an informed consent form, interacted with both mediums, and answered basic questions regarding the content found in them and their experiences [9].

The next iteration of development included improved design and added historical information that became available by *Thomsen, J. Woerun, J. Haagensen, H. 1968.* [15]. Thomsen's archival documentation and additional documentation of the "Bungamati Temple" and additional archival footage from the "Taragaon Museum" in Kathmandu, Nepal allowed us to authenticate Bungamati's structures and its cultural heritage information. The display of

Figure 4: Bungamati Temple and the surrounding area in Nepal, developed at the GameLab (http://www.ubalt.edu/gamelab) for the head-mounted display (HMD) virtual reality mobile application.

historical information and user-interaction addressed in this phase solved issues that persisted in the first study. We could integrate navigation and interaction with the mobile platform in the HMD device. This enabled users to find historical information efficiently (Figure 4). Some programming anomalies were identified and corrected. Other technical corrections included the frame rates and frequency rates in the mobile platform.

In an HMD system, a participant was given plentiful time to familiarize themselves with a sample task of navigation, interaction with cultural and historical artifacts. Upon completion of each setup, each participant was asked to switch to the alternate setup to carry out the same familiarization tasks. Same as the CAVE setup in the first study, participants could navigate and locate patterns of objects, shapes with historical significance allowing users to identify and search for historical information and artifacts through three-dimensional models, text and images presented side by side. Many of the historical information and artifacts were modeled and sometimes scanned and photographed as reference images in the virtual reality environment. The text-based supporting documents that were retrieved from historical archives were translated in English language. The three-dimensional modular and interactive models were the representation of the physical, historical area of "Bungamati" temple and surrounding area.

Overall, participants reported significant improvement of using HMD as a new technology and finding historical information. They also reported significant improvements in ease of use when asked about ranking HMD as a tool. When asked about their experience with the CAVE compared to the HMD display, participants reported CAVE as a better tool to carry out preservation related tasks. Participant's self-reporting showed the HMD might better disseminate cultural heritage preservation. Figure 4., shows the final version of the "Bungamati" temple that was transformed into the HMD virtual reality mobile application. It is being modified to fit in multiple mobile devices that can be accessible world-wide through the web. In addition, the is developing digital preservation work of other cultural and historical monuments in the Kathmandu valley, including the UNESCO world heritage sites in Nepal.

Conclusion

This paper brings an array of possibilities in the digital preservation domain using virtual reality and designed through studies of human interaction technology. Artists, developers, archeologists, scientists and scholars from multiple discipline can work in the preservation domain in exploring innovative solutions in converting and sustaining cultural heritage into a three-dimensional interactive virtual environment. That will allow us to identify cultural heritage with unique perspectives. This technique will allow scholars from multiple discipline to work together in digital humanities. Using this technique may offer a technological alternative to articulate, process and disseminate historical data. Sustaining cultural heritage also provides an ideal opportunity to access user interaction related research and development. It facilitates scholars to work and develop field

research and develop a research method that is critical in the field of interdisciplinary studies. Visualization of cultural heritage in a mobile VR platform addresses and provides insight into lost historical innovation and creativity that may influence future development of tools and technologies. It can become a vital tool in contemporary research in accessing complex visual processing and interactive components in the domain of scientific visualization. The potential of scientific visualization of cultural heritage and collections have a greater impact on teaching and learning for people all over the world.

Bibliography

1. Lazinger, S. 2001. Digital Preservation and Metadata: history, theory, practice. Journal of the Society of Archivists.
2. Barris, K. 2007. "To Be Virtual … or Not to Be: Theatre Museum Canada's Travels into the World of Technology", Canadian Theatre Review, (131), 49-52.
3. Chen, K. B., Kimmel, R. A., Bartholomew, A., Ponto, K., Gleicher, M. L., & Radwin, R. G. 2014. "Manually Locating Physical and Virtual Reality Objects", Human Factors: The Journal of the Human Factors and Ergonomics Society, 56(6), 1163-1176.
4. Chen, S. 2001. "The paradox of digital preservation", Computer, 34(3), 24-28.
5. Lists of Intangible Cultural Heritage and the Register of good safeguarding practices - intangible heritage - Culture Sector - UNESCO. (n.d.). Retrieved January 19, 2018, from https://ich.unesco.org/en/lists/Culture
6. Hedstrom, M. 1998. "Digital Preservation: A Time Bomb for Digital Libraries", Computers and the Humanities. 31 (3), pp. 189-202.
7. Ikeuchi, K., Oishi, T., Takamatsu, J., Sagawa, R., Nakazawa, A., Kurazume, R., Okamoto, Y. 2007. "The Great Buddha Project: Digitally Archiving, Restoring, and Analyzing Cultural Heritage Objects", International Journal of Computer Vision Int Comput Vis, 75(1), 189-208.
8. Bonn, M., Kendall, L., & McDonough, J. (2016). Preserving intangible heritage: defining a research agenda (p. 9). Presented at the Proceedings of the 79th ASIS&T Annual Meeting: Creating Knowledge, Enhancing Lives through Information & Technology, American Society for Information Science. Retrieved from http://dl.acm.org/citation.cfm?id=3017447.3017456
9. Shrestha, S., Chakraborty, J., & Mohamed, M. A. (2016). A comparative pilot study of historical artifacts in a CAVE automatic virtual reality environment versus paper-based artifacts (pp. 968–977). Presented at the Proceedings of the 18th International Conference on Human-Computer Interaction with Mobile Devices and Services Adjunct, ACM. https://doi.org/10.1145/2957265.2962644
10. Caffo, R. 2014. "Digital Cultural Heritage Projects: Opportunities and Future Challenges", Procedia Computer Science, 3812.
11. Fresa, A. 2014. "Digital Cultural Heritage Roadmap for Preservation", International Journal of Humanities and Arts Computing Intl J Humanities & Arts Computing, 8(Supplement), 107-123.
12. Shrestha, Sangam. 2015. Conservation of the cultural heritages of Kathmandu valley. Laurea-ammattikorkeakoulu.
13. Yan Peng, L. 2011. "Virtual Reality as a Means for Preserving Digital Heritage: Masjid Jamek", International Journal Of Interdisciplinary Social Sciences, 5(9), 119-128.
14. Cruz-Neira, C., Sandin, D. J., & Defanti, T. A. 1993. "Surround-screen projection-based virtual reality", Proceedings of the 20th Annual Conference on Computer Graphics and Interactive Techniques - SIGGRAPH '93.
15. Thomsen, J., Woerum, J., Haagensen, H. "Bungamati 1968, A Survey by Danish Architect Students", Center for Cultural and Development, Embassy of Denmark.
16. Donatella Lorch, Special for USA TODAY: Voices: Like post-earthquake Nepal, Red God is in limbo. (n.d.). Retrieved September 12, 2016

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Chemical Skin - Computer Numeric Controlled Craftsmanship (CNCC)

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Abstract

Most 3D printing technologies excel in delivering geometric complexity, functionality and part precision. Yet, most are not designed to adequately articulate the surface of 3D printed elements with complex patterns, motifs, or colouration. The problem of synthesis between form and surface reaches back to the first forming of clay vessels and the added surface articulation as glazing after the firing of the clay form. In the long history of Chinese ceramics, craftsmen were able to balance an intricate knowledge of material reactions, form, and glazing during the firing process with curiosity and the will to innovate.

This paper presents the results of our investigation into transferring this ancient craft – it combines scientific, historical, cultural and technical considerations to analyze and reflect on the digital making process of a glaze for 3D printed objects. Through an experimental, yet inclusive interdisciplinary research method using a combination of material experiment as well as catalogue and design application, we created an index of suitable chemical reagents and developed robotic and software tools for their application on 3D printed surfaces. The resulting digital craftsmanship is able to extend the repertoire of today's digital working artists and designers.

Keywords

3D printing, CNC, CAD, Cyanotype, Digital Craftsmanship, Laser

Introduction

The impact and urgency of our research into the surface articulation of 3D printed objects is economically supported by the success of 3D printing as a game-changing invention with the value of the Additive Manufacturing Industry in 2015 estimated to be $5.165 billion [1]. Yet, the validity of the research is not primarily based on its economic potential. Its impact through the making of new objects will affect the transfer of images and cultural legacies from one medium and technique to another. This is not only an experimental, technological innovation, but also a form of culturally-led intervention of science into applied arts.

Our research into the transfer of craftsmanship methods to the chemical augmentation of 3D printed surfaces, using digitally controlled activation, results in the development of digital tools and chemical processes that enable new material based expressions for artists and designers. This paper will describe the robotic set-up, chemical recipes and procedures that enabled the precise activation of 3D printed surfaces coated with cyanotype – a photosensitive chemical that changes colour when exposed to UV radiation. We provide a cultural framework to compare this new method to the traditional craft of ceramics.

Design Processes: In ceramics, an object is handmade and all processes are applied analogue to the object - truly emphasizing the relationship between the craftsman's hand and the object [2]. In our project, we aim to extended the digital ontology of 3D printing to the articulation of its surface properties. This post-process operation extends the existing workflow of 3D printing. Our research enables artists and designers to transfer key characteristics of ceramic craftsmanship such as stroke width and type, gradient intensity of lines from analogue to digital – embodying 3D printed objects with artistic merit, variety and expressions.

Material Combinations: Material experiments have been at the core of the development of ceramic glazes. Different firing processes and glazing chemicals allowed new colours to emerge and resulted in a plethora of artistic expressions [3]. Seeing the tremendous impact material libraries have on art and design, [4] we have experimented with common 3D printed substrates (PLA, ABS, Nylon, TPU...) to confirm their compatibility with our processes.

Tools for Making: Compared to the ability to produce geometrically complex forms in 3D Printing, the inability to create surface articulation on the printed objects means simple details on toy figures still demands to be painted by hand. Automatic methods to print on complex surfaces with high definition is becoming increasing relevant and urgent. Recent development such as the precise hydrographic printing and thermoforming are producing a measureable impact in research and the industry [5]. This paper describes a novel method to overcome the reachability problem when printing on complex surfaces. By uniformly coating the object with photosensitive chemicals and selectively exposing the area with laser beams, no direct contact is necessary. Any surface that is visible can be subjected to lazing.

We have developed a comprehensive approach that encompasses artistic, technical and historical resources in

order to deliver a culturally engaged research output. This approach can be explained over three key areas.

First, we highlight the cultural significance of ceramic painting as a role model to our research. The intricate interplay between technological advancement and artistic expression in this craft allows for research as an interdisciplinary undertaking that combines art, technology and science.

Second, we explain the technical foundation that leads to the use of cyanotype. This includes the analysis of the technical requirements and challenges to coat plastic surfaces with photosensitive chemicals. It also includes discussions on photo-reactive chemicals in alternative photography and technical research on their activation via computer controlled manipulation of laser beam.

Finally, we present a series of experiments conducted to validate our research approach. These experiments act as proof of concept of our printing method applied to a range of plastic materials with planar and 3D surfaces . A palette of artistic expression is presented such as line width, colour intensity, hatching patterns and gradients of colour patches. The experiments are contextualized within the cultural dimension of the research – the interdisciplinary transfer of traditional into digital craftsmanship techniques. This contextualization frames the project not only as an engineering problem or design research, instead it constitutes an innovative approach to articulating a synergy between craft and technology

Craft as a role model for innovation - Historic Dimension

The earliest surface expressions reach back to the New Stone Age. Artefacts from the excavations in Banpo, Miaodigo and Majiayao show a great variety of ceramic paintings depicting decorative motifs, human faces, fish and abstract intricate patterns. These motifs were applied to the surface either before the firing process or, in the case of burial artefacts, after the firing process. It was not until the Tang dynasty that craftsmen in Changsha, Hunan (China) developed new methods and kiln firing techniques that led to the establishment of chemical underglaze using pigments derived from oxides. This allowed for new forms of expression and for the re-articulation of elaborate landscape motifs and more complex patterns to emerge. At the same time as opening up a plethora of artistic expressions, the development of the underglaze and the associated glost firing (firing the ceramic twice and at higher temperature first) limited the spectrum of colours that could withstand the higher temperatures of the first firing process. During the Song dynasty, experimentation and curiosity at the Cizhou kilns (now called Handan in Hebei province) led to the development of a much wider range of colours. White glaze with black underglaze, and the development of red and green glaze, allowed for further artistic freedom. Finally, with the development of the classical white and blue glaze through the use of cobalt oxide, artistic expression was able to articulate up to five shades of colour and hence achieve depth in the depiction of landscapes and natural motifs [6].

Today, the centre of ceramic artistry in China is located in Jingdezhen, Jiangxi province. The city is known to nurture new artistic creativity and engender the development of new ceramic and glazing techniques. It is a reminder that this craft is still highly contemporary and that its culture is alive. The results generated by this community range from new material approaches, new glazes, new firing techniques and new artistic concepts. This exemplary experimentation is a model and subject for our research into surface articulations for 3D printed substrates and the changes it will bring for the creative industry.

Ceramic painting process

The concept behind many of the ceramic painting methods is the interplay between various types of glaze, various temperatures of firing and the correct sequence in between the firing stages and the respect of the behaviour of the glazes with regards to the geometry they are applied onto. Most types of glaze are based on mineral oxides as these are able to withstand higher temperatures in the firing, yet each glaze has its specific behaviour in terms of melting fluidity, temperature expansion and colouration changes. Broadly speaking, a glaze can be characterised as a chemical component that when applied to pottery, fuses with the substrate when placed in a kiln at high temperature.

In general, glazes can be categorized in two types of glaze with specific application. This simplification allows transferring the logic of glazes from the traditional craft to the application into today's additive manufacturing.

First, in order to create higher levels of articulation and colour differentiation, glazes need to be applied in layers. The first layers of glaze will be able to dry without necessarily firing them. However, the layer thickness of these needs to be controlled, as well as the melt fluidity of each ingredient of the glazes. For example, if one uses two layers and both glazes have high melt fluidity, each layer will need to be thinner than normal as otherwise the surface will need to be roughed with contours to be able to tolerate more running.

Alternatively a fluid first layer and a non-fluid second will result in the risk of the second layer's weight creating a downward pull and destroy the first layer.

There are numerous constellations of this and with increasing complex and multi-coloured glazes, this chemical behaviour extends. Yet, they all together are called 'underglaze'. One important observation at this point is the deviation from traditional pottery, which often uses dipping techniques to apply glaze and the currently more widespread use of commercially-prepared brush on glaze. As with low fire, these high temperature prepared glazes have added gum to make them paintable. Although this process is slow (compared to dipping) and it is more difficult to get even coverage, the opportunity to layer glazes of different colours and characters to produce reactive visual effects has become highly appealing to many potters. This process is also a point of translation in our digital craftsmanship, the concept of layered applied chemicals with different properties in the laser activated chemical coating.

The second process, after drying the various applied underglazes or in some cases as well firing the underglazes so called biscuit firing, is the glaze. This is used to allow

shine and reflection to coat the surface and hardens the entire surface.

The last process is called over glaze. It involves relatively low temperature glaze chemistry. Usually, an "overglaze" is only used in small areas over the glazes and fired surface. The object will need to be fired again after this application.

In each of the glazing steps, the glaze can be applied via dipping or brushing. For us, the transfer of the logic in this craft lies in the layering of chemical coating and the multi stage processes of photographic exposure and fixing. The main technical challenge were in creating the chemical coating with a chemically compatible binder and the preparation of the surface where it would be applied. Within this challenge, consistency and repeatability is particularly important. Secondly, we need to create the optical setup for delivering a highly parallel laser beam for the photochemical activation of the coated surface of the 3D print. And, lastly, similar to the glaze, what would protect the layer and stop the curing process?

The problem with printing on geometrical complex surfaces

In the context of 3D printing, aesthetically appealing consumer products did not emerge until the invention of powder-bed inkjet printing which offered gradient multi-colour printing (Z Corporation, 3D Systems). Additionally, hot vapour smoothing process provided glossy finished 3D-printed parts [7]. Both methods however are only applicable to a very small range of objects due to the extreme chemical specificity of the hot vapour methods, being limited to ABS and PLA plastics and the structural weakness of the powder-bed process.

Alternatively, printing on non-planar surfaces is a long-standing challenge in product design and manufacturing. Existing techniques such as inkjet printing allow surface fluctuation only within a few centimetres [8]. Letterpress offset printing [9] and screen printing [10] can conform to developable surfaces due to the cylindrical shape of the offset transfer drum and the flexibility of the silkscreen, but are not applicable to non-developable surfaces where the silkscreen needs to be distorted when being wrapped. Recent research in hydrographic printing technologies [11], [12] and thermoforming [13] provided a new way to create complex 3D objects with high resolution texture. However certain geometries with convex hulls and high surface curvature cannot be hydro-printed and thermoforming cannot produce closed objects.

Another approach to creating surface articulation is by laser marking. A highly focused laser beam is used to vaporize, stain, oxidize or anneal the surface of an object. However, the designer has no control of the resulting colour. [14]. A variation of the method uses laser to remove the top paint coat of an object, providing a two colour result [15].

Our approach

Our goal is to harness the precision, repeatability, and easy re-programming of computer controlled machines in articulating monochromatic 3D printed objects by digitally control laser exposure of a photographically sensitized coating. We apply and activate chemical coloration directly on the surface thus, in the analogy to the glaze firing, are firing the chemical directly onto the surface. The advantages of our research trajectory are a lower machining cost, lower maintenance, less invasive material tensions and no longer applying mechanical forces during the process of application of a surface to the 3D printed form.

The disadvantage is the lack of high fidelity colouration that hydrographic and thermoforming both incorporate through transfer of existing printing technologies. Additionally, our research provides a new application for the recently maturing 3D position and registration techniques (such as photogrammetry and laser scanning) that can precisely relate a physical object to its digital model.

Both physical models that originate from a digital file via 3D printing and models that are hand crafted can benefit from this workflow. This enables a downstream digital design process for surface patterns and articulations that can be digitally simulated, visualized and precisely fabricated. There are two main technical challenges. First, is to identify a chemical mixture that can be activated using UV light and fixed after the process, and second, to develop the appropriate software and hardware tools to register the object and precisely activate the chemicals on complex surfaces.

The chemistry – Alternative Photographic Process

Our research focuses on photosensitive chemical processes that can be activated using laser light. Compared to infrared sensitive chemicals, UV sensitive chemicals are more available in the market. Before the widespread use of silver nitrate gelatine photography, many chemists and photographers conducted research into alternative reagents suitable for photographic film and photographic paper. These chemical process are now retrospectively classified as 'alternative photographic process' [18]. We selected from these well-studied photochemical reactions and focused on those that can provide a change in colour of the reagents upon activation and is stable after fixation. One of these historical processes is the cyanotype process [19], otherwise known as blueprint. The cyanotype process is capable of reproducing very fine lines with high fidelity as witnessed in the famous photographic botanical book - Photographs of British Algae: Cyanotype Impressions [20].

In our experiments, we successfully tested the technical aspects of applying UV light reactive cyanotype mixtures onto the surface of the most common and widely available 3D printed surfaces. A key challenge, emerging through this initial testing, was to overcome the difficulty in coating uneven 3D printed surfaces. Historically, photographic chemicals are coated onto either fibrous paper or material with high surface energy (easy for solutions to wet and adhere) such as glass [21].

However, 3D printed objects have very different surface textures depending on the processes used for printing. For example, a highly absorbent surface from gypsum powder prints reacts differently to a low surface energy plastic surface from SLA prints [22]. These surface properties initially prevent the photochemical coating to adhere or disturb the fixing process and a binding layer needed to be introduced between the substrate and the coating [23].

The tool - Selective Laser Activation

The main challenge in precisely activating a layer of photosensitive chemical – coated on non-planar, complex surface – is the difference in projection distance and thus the constantly need to change focus. We overcome this problem by using a highly collimated laser beam for projection, which does not require focusing [24].

We have initially explored the use of a 500mW 405 nm diode laser mounted on a simple linear platform for activating the cyanotype. Later, we also experimented with the use of scanning laser projection. Scanning laser projection technology has been available for many years for entertainment purposes but finds limited use in high fidelity video projection due to its monochromic colour and low refresh rates. However, it is ideal for our application because our chemical activation does not require high refresh rates nor colour projection. A pair of mirror galvanometers is commonly used to change the projection angle of the laser beam. With the recent advances in digital to analogue converters (DAC), such mirrors can be controlled with 12 bits of resolution - equivalent to a 16 megapixels / 4K screen [25].

We have struggled to purchase a laser source of good characteristic that can create high resolution and sharp images within our budget. A low-cost diode laser was modified by adding a custom pinhole, to provide a clean wave front for such a purpose [26].

Lastly, regarding the robotic platform. It is possible to deploy the laser with various degrees of freedom (DOF) - from 1DOF turntables to 6DOF. This will allow positioning a 3D printed object in such way, that all of its surfaces can be exposed by the laser projection. In our experiment we constructed a custom 2-DOF robotic platform that contains a turntable and a linear z-axis. Variable colour intensity can be created by controlling the amount light exposure, by modulating laser intensity or exposure time.

Underglaze_New Photosensitive coating

The cyanotype process is a historically significant photographic process before the advent of silver nitrate printing process. It was also used extensively as a photocopying method by architects and engineers and earned its commonly known name as 'blueprints'. The photographic reaction took place when ferrous cation and ferricyanide anion in the sensitizer is exposed to light. The soluble salt is reacted to give ferric ferrocyanide which is insoluble and possess an intense blue colour, commonly known as Prussian blue.

There are multiple methods to prepare the cyanotype sensitizer. Traditionally, it is done by mixing aqueous solution of ammonium iron (III) citrate and potassium ferricyanide [27]. Despite its popularity and long history, this preparation method suffers from unpredictability and inconsistency. One of the reasons is the difficulty to obtain a pure source of ammonium iron (III) citrate. In 2004, Mike Ware published an improved preparation method in his PhD thesis [28]. His sensitizer has a faster reaction, stronger blue color, wider dynamic range and most importantly high consistency. His method uses ammonium iron (III) oxalate instead of ammonium iron (III) citrate, and involves a super saturation purification step. Although it requires more laboratory equipment and preparation time, we have considered the higher predictability and consistency to be significantly advantageous. We have therefore followed Ware's preparation method in this publication.

In light of the intention to spray the cyanotype coating onto complex surfaces, we have not added the toxic ammonium dichromate that improves contrast

Binder

No binder was used in the traditional cyanotype process on paper substrate. The liquid sensitizer is first rolled onto the paper and air dried, before photographic exposure. The cellulose fibre absorbs and retains the dehydrated cyanotype salt. After exposure, the unreacted cyanotype can be washed from the paper while the insoluble Prussian blue is trapped in the paper fibre. The goal of our project is to apply the cyanotype process onto 3D printed surfaces, which are predominantly made of plastic material with no absorbance. A binder is necessary for the Prussian blue to stick to the surface after exposure and washing.

We have identified gelatine among other photographic binders suitable for creating an emulsion with the cyanotype sensitizer. Gelatine is a translucent and colourless material derived from collagen obtained from animal parts. When dissolved in a small amount of hot water, its viscosity changes increase dramatically as temperature decrease, eventually forming a gel at lower temperatures. When dried, the gelatine provides a chemically stable layer that can hold the soluble cyanotype and the insoluble Prussian Blue crystals. During the washing process, the gelatine layer swells and allows the unreacted soluble cyanotype to dissolve out, yet retaining the Prussian Blue, thereby achieving a photographic fix.

By controlling the gelatine concentration, we are able to obtain a gel that has low viscosity at warm temperature (70 – 80 degrees Celsius) and has high mechanical strength when cooled to room temperature (22 degrees Celsius) [29]. Alcohol was added as a quick drying solvent to reduce the viscosity and allows the coating to be sprayable. Citric acid was added to improve the photographic clarity of cyanotype and avoid 'fogging' due to impurities [30]. Tween 20 was added as surfactant to improve wettability.
To prepare the photosensitive coating, we dissolved the gelatine powder in warm water using a hot water bath. Diluted alcohol was slowly added with stirring until viscosity reaches a sprayable state. Tween 20, citric acid and the cyanotype were added subsequently and stirred. The coating was then ready to be sprayed.

Glaze_Substrate Preparation and Spray Coating

We have performed most of the coating and exposure experiments using flat ABS plastic sheets (60mm x 120mm) as substrates. It was necessary to roughen the plastic surface by sanding to improve coating adhesion. For FDM printed substrates, it turned out to be ideal to first remove the highly visible layering artefact with a vapour polishing step (ethyl acetate and acetone can be used to polish PLA and ABS prints respectively). Sanding pads can

be used to roughen the printed surfaces. For SLA resin and SLS nylon based material, depending on printer settings, the surface roughness may be sufficient for coating adhesion and no further sanding is required.

A double action airbrush with 0.3mm nozzle was used to spray the coating. Spraying distance was maintained between 100 and 150 mm. The aim is to apply a single continuous coat of wet paint across the surface of our plastic substrate. Care must be taken not to spray excessively and cause dripping. Incandescent light should be used in the spray painting room and sun light should be blocked. The coated substrate is immediately placed in a dark box for drying. 2 to 4 hours of drying time is needed depending on air humidity. The coating has a lime-yellow color with matte texture after drying.

The Kiln_ Laser Exposure Machine

The cyanotype reaction is sensitive to wavelength between 210nm to 410nm [31]. We used a 500mW 405nm multi-mode UV laser module mounted on a 2 DOF CNC machine (fig.1) to selectively expose the cyanotype-coated objects. The focus lens was adjusted such that the laser beam is as parallel as possible. A pinhole with 0.1mm diameter was placed in front of the laser module to circularize the laser spot by cropping. The laser module and the pinhole are mounted on a screw-driven linear robotic module with 200mm linear travel and 0.00625 mm positioning accuracy. The coated object is placed on a 270mm diameter belt-driven robotic turntable that is capable of continuous revolution, with 0.0075 degree positioning accuracy. The laser beam is positioned parallel to the surface and passes through the center of this turntable. Custom shaped fixture is required for each freeform shaped object. A calibration point is marked on the fixture and the laser beam is moved to that point to zero the machine.

Fig. 1 Custom CNC controlled laser positioning machine for laser exposure experiments © copyright Authors, Photo Authors

This two degrees-of-freedom machine allows us to perform laser exposure experiments on planar and freeform surfaces. Its axis configuration predominately favours tube-like objects to be exposed on all sides. Two NEMA 17 stepper motors are used to actuate the linear and rotary axis. They are driven by industrial stepper motor drivers with micro stepping enabled.

A laser path file is modelled and generated using custom written script in Rhino 5 using Grasshopper plugin. The file is written in G-Code and sent via USB serial port to an Arduino microcontroller running grbl v1.1 CNC controller. The controller can perform synchronized movement of the two axes with programmable speed. It can also modulate the laser output power from 0% to 100%. By controlling the moving speed of the axis or the laser power, we can control the exposure intensity (in J/mm^2) over the area swept by the beam spot. In practice, we always use the laser in 100% power and vary the path-tracing speed, this can minimize the lazing time.

First Laser activated Cyanotype Glazes

In order to develop this photographic printing method for artistic application, a number of experiments were conducted to achieve a control of the exposure intensity. As explained before, the exposure intensity along the laser path can be controlled by changing the path tracing speed. This creates lines of equal width (approximately 0.2mm) with different blue intensity. The width of the lines can be changed by using a pinhole with different diameters.

Due to the vector nature of the laser beam, it produces only line drawings. Patches of colours have to be created by scanning the beam over an area. The colour intensity of the patch is determined by the scanning speed and the scanning spacing.

Therefore, we created a number of sample cards (fig.2) to adjust and calibrate different colour patch intensity with differently spaced diagonal straight hatching. Other types of hatching pattern can create different visual effect similar to the techniques used in intaglio prints.

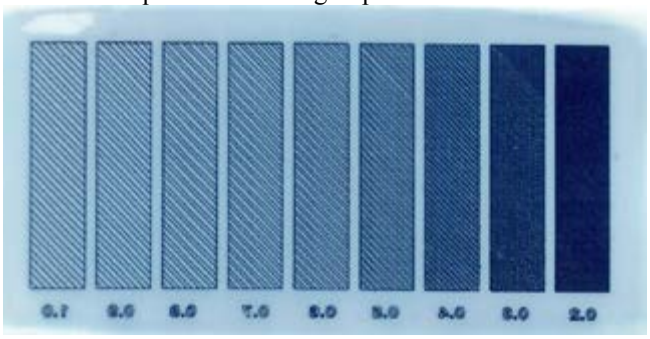

Fig.2 Hatching sample card with different hatch spacing. © copyright Authors, Photo Authors

We extended the hatching test to demonstrate the two effects at the same time (fig. 3). From top to bottom, the L-shaped lines have decreasing spacing. From left to right, the lines are exposed with increasing speed. An artist can pick the desired visual outcome from the matrix and program the laser with the corresponding speed and spacing. It should be noted that the laser speed is not directly proportional to the exposed blue color intensity.

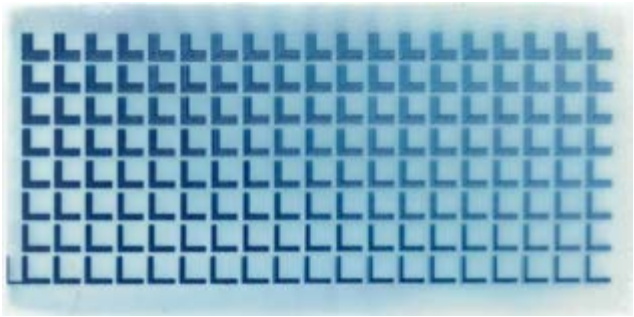

Fig.3 Gradient and line graphic printed on flat ABS plate © copyright Authors, Photo Authors

Lastly in this test series of working with a planar surface exposure, we created the intricate image of a Chinese flower painting as traditionally seen on the classic blue and white ceramic paintings. We used, as discussed gradients described through variation of hatchings as density of lines with exposure differences (fig. 4). The gradient patches are created with equal hatching spacing and varying laser speed. Custom scripts allow the artist to select the starting and ending intensity and the orientation of the hatching. The substrate is ABS sheet (60mm x 120mm x 2mm) roughened with sand paper. Total laser exposure time is approximately 2 hours.

Fig.4 Gradient and line graphic printed on flat ABS plate © copyright Authors, Photo Authors

In the current state of the research we have achieved control over the parameters described before on planar surfaces. Furthermore and in plane with the rotational geometries of traditional pottery, we have achieved to successfully adjust the parameters of our current set-up to print on double curved 3D printed objects. To demonstrate this ability, we printed (Fig. 5) a vector image on a circular bracelet (80mm diameter, 18 mm height). The substrate is PLA plastic printed with FDM 3D printer, vapour polished and then roughened. The exposure time is approximately 40 minutes.

Fig.5 Vector graphic printed on FDM printed PLA bracelet © copyright Authors, Photo Authors

Conclusion

Digital Craftsmanship is still an under-defined concept. It involves the ability to control tool and material to artistically creating a synthesis between them. Certainly, the construct of Craftsmanship, independent of the analogue or digital, is a cultural construct embedded within a technological context. Historically, the craftsmen have understood the value of combining technology and art into an interdisciplinary approach and as shown throughout the last millennia, curiosity and the will to innovate has driven artistic expression and technological development. The relationship between tool development and artistic expression is undeniable.

Within this research, we adopted techniques and methods from one of the oldest artistic expression and transferred them to the current state of the art additive manufacturing technologies. We focused on the development of tools for today's digital artists and designers and the global maker community.

In this technological yet as well cultural context, we are speculating that the artistic response to a new expression and tool will, as with all new developed media, from the printing press to stereoscopic projection, open a plethora of translations, use and misuse of the developed media and create output and discussion about the relationship between techne and poiesis.

We are happy to contribute.

Acknowledgements

The authors would like to thank Wang Xiao Tong for her assistance in conducting the experiments. The work described in this paper was partially supported by a grant from the Research Grants Council of the Hong Kong Special Administrative Region, China (project number: CityU 21611115) and the internal ACIM fellowship grant by the School of Creative Media, City University of Hong Kong

References

1. Caffrey, Tim, Terry Wohlers, and R. I. Campbell. "Executive summary of the WohlersReport 2016." (2016)
2. Sennett, R., 2008. The craftsman. Yale University Press.
3. Rice, Prudence M. Pottery analysis: a sourcebook. University of Chicago Press, 2015.
4. Miodownik, M., 2013. The Institute of Making Mark Miodownik reveals the story behind the creation of the Institute of Making: The right environment to solve real world, complex problems. Materials Today, 16(12), pp.458-459.
5. Zhang Y., Yin C., Zheng C., Zhou K. Computational Hydrographic Printing, ACM Transactions on Graphics (TOG) - Proceedings of ACM SIGGRAPH 2015 Volume 34 Issue 4, August 2015, Article No. 131
6. Rice, Prudence M. Pottery analysis: a sourcebook. University of Chicago Press, 2015.
7. Garg A, Bhattacharya A, Batish A. On surface finish and dimensional accuracy of FDM parts after cold vapor treatment. Mater Manuf Processes 2015; DOI: 10.1080/10426914.2015.1070425
8. Castrejon-Pita, J.R., Baxter, W.R.S., Morgan, J., Temple, S., Martin, G.D. and Hutchings, I.M., 2013. Future, opportunities and challenges of inkjet technologies. Atomization and Sprays, 23(6).
9. Toyo Seikan Co. Ltd, Japan, Plastic Bottle Decoration Technical Manual
10. MacDougall, A., 2008. Screen Printing Today: The Basics. ST Books, a division of Media Group International.
11. Zhang Y., Yin C., Zheng C., Zhou K. Computational Hydrographic Printing, ACM Transactions on Graphics (TOG) - Proceedings of ACM SIGGRAPH 2015 Volume 34 Issue 4, August 2015, Article No. 131
12. Panozzo D., Diamanti O., Paris S., Tarini M., Sorkine E., Sorkine-Hornung O. Texture Mapping Real-World Objects with Hydrographics. Computer Graphics Forum, Volume 34 Issue 5, August 2015, Pages 65-75
13. Zhang, Y., Tong, Y. and Zhou, K., 2017. Coloring 3D printed surfaces by thermoforming. *IEEE Transactions on Visualization and Computer Graphics*, *23*(8), pp.1924-1935.
14. Qi, J., Wang, K.L. and Zhu, Y.M., 2003. A study on the laser marking process of stainless steel. Journal of Materials Processing Technology, 139(1), pp.273-276.
15. Trotec Laser GmbH, 2016, Laser Marking with Trotec Laser Machine
16. Zhang Y., Yin C., Zheng C., Zhou K. Computational Hydrographic Printing, ACM Transactions on Graphics (TOG) - Proceedings of ACM SIGGRAPH 2015 Volume 34 Issue 4, August 2015, Article No. 131
17. Panozzo D., Diamanti O., Paris S., Tarini M., Sorkine E., Sorkine-Hornung O. Texture Mapping Real-World Objects with Hydrographics. Computer Graphics Forum, Volume 34 Issue 5, August 2015, Pages 65-75
18. Lenman, R. ed., 2005. *The Oxford companion to the photograph*. 'Alternative (non-silver) photographic processes' Oxford University Press
19. Ware, M. (2014). Cyanomicon: History, Science and Art of Cyanotype: Photographic Printing and Prussian Blue. WWW. mikeware. Companyuk.
20. Atkins, A., 1853. *Photographs of British Algae: Cyanotype Impressions*. Anna Atkin
21. Richard, F.A.R.B.E.R., 1998. Historic Photographic Processes.
22. Wai Ming, Ling, and Ian Gibson. "Possibility of colouring SLS prototypes using the ink-jet method." Rapid Prototyping Journal 5.4 (1999): 152-154.
23. 3M, 2015 Innovations in Bonding to Low Surface Energy Surfaces
24. Hollemann, G., Braun, B., Dorsch, F., Hennig, P., Heist, P., Krause, U., Kutschki, U. and Voelckel, H.A., 2000, April. RGB lasers for laser projection displays. In *Projection Displays 2000: Sixth in a Series* (Vol. 3954, pp. 140-152). International Society for Optics and Photonics.
25. Lamp Free, Laser Projectors (http://www.digitalprojection.com/emea/laser/, 2017)
26. Deter, C. and Kraenert, J., 2000, April. High resolution scanning laser projection display with diode pumped solid state lasers. In *Proc. SPIE* (Vol. 3954, pp. 175-184).
27. Wall, E. J., & Jordan, F. I. (1947). Photographic facts and formulas.
28. Ware, M. (2014). Cyanomicon: History, Science and Art of Cyanotype: Photographic Printing and Prussian Blue. WWW. mikeware. Companyuk
29. Gelatin Handbook. Gelatin Manufacturers Institute of America, 2012. Dostupné z: www. gelatin-gmia. com/images/GMIA_Gelatin_Manual_2012. Pdf
30. Ware, M. (2014). Cyanomicon: History, Science and Art of Cyanotype: Photographic Printing and Prussian Blue. WWW. mikeware. Companyuk.
31. Turner, J., Parisi, A. V., Downs, N., & Lynch, M. (2014). From ultraviolet to Prussian blue: a spectral response for the cyanotype process and a safe educational activity to explain UV exposure for all ages. Photochemical & Photobiological Sciences, 13(12), 1753-1764.

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Between technological precision and artistic ambiguity in Locative Art.

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Abstract

This paper discusses how ambiguity can mean a virtue rather than a problem in Locative Art domain. Pervasive media, which has the clinical precision as one of its key features, can reduce the understanding of location to a pure residue of a Cartesian coordinate system. The author argues that ambiguity, when applied to good effect in artworks supported by such monitoring systems, can encourage new mapping metaphors, which gives less emphasis to the point-to-point correspondence of the digital tracking. To orient the discussion, this paper focuses on *Chronica Mobilis* example. The qualitative analysis of this experimental artwork describes how it generates a dialogue between the determinism of geospatial technologies and the freedom of participants' creative and performative actions.

Keywords

locative art, participatory cartography, neocartesianism, politics of mapmaking, situationism, mobile media, embodied interaction, navigation, urban space, ambiguity.

Introduction

In the turning of the millennium, the artistic domain celebrated the developments in digital and satellite mapping as "the next big thing" for delivering aesthetic and cultural experiences within urban spaces (Tuters & Varnelis, 2006). The technological innovation, claimed to have the ability to generate highly accurate representations of our physical surroundings, supported a diverse scope of projects anchored in the use of location and spatial positioning data. The urban space turns into an artistic territory for approaching location through different mapping practices. Artists explored the context-aware capabilities of the technology to associate personalized information to specific contexts, to interweave the physical and the virtual domains, the urban and the electronic flows[1].

The current integration of context-aware technologies in mobile devices amplified the possibilities of such artistic practices enabled by locative media. The widespread of mobile personal computers also contributed to the increase of monitoring practices. While pervasive media became part of a consumer desired technology of the 21st century, surveillance turned into a real threat to the individual privacy rights, with users' activities and personal information concentrated on the hands of few corporations. Addressing critic questions regarding the meaning of locating and be located in the current days became a crucial matter to artists working with locative media (Pinder, 2013). Rather than cartographic precision, one of the potential opportunities opened up by context-aware technologies is the possibility to express location outside of standardized forms, what includes to play with new forms of presence in contemporary digital cities.

This paper has a focus on the experiences inserted in the realm of public art, in which location appears as an aesthetic element. How can artworks approach the clinical accuracy of a tracking media traditionally created and employed for military goals? Can we take ambiguity and uncertainty in interpret location and its sociocultural aspects as a potent resource in the artistic practice supported by the determinism of positioning technologies?

The answer to these questions can support the critical thinking about the role artists play in proposing particular experiences in public space through creative approaches to locative media. This paper anchors on the case study analysis of an experimental performance geolocated in the public space to evaluate such possibilities. *Chronica Mobilis*[2] is an artwork that approaches location through a self-mapping participatory practice enabled by locative media to create subjective articulations to perform and represent space.

Beyond a Technology-enabled Situationism

Situationism regularly appeared as a precursor of the cartographic practices adopted by Locative Art. If not a precursor of a Neocartesianism or a Technology-enabled

[1] *Blast Theory* is one of the precursors in this field with with location-based projects such as *Can You See Me Now*? (2001) and *I Like Frank* (2004), both devoted to investigate the interface, the properties and the boundaries that separate an electronic and a physical space.

[2] http://chronicamobilis.net

Situationism, it is at least an inspiration for artists working with geospatial data. The aesthetic form of the dérive, for instance, became prominent among the artistic use of context-aware technologies.

The experimental *dérive* method appeared to attend the lack of influential maps able to change architecture and urbanism (Debord, 1958). Situationism, as a social movement in the context of the 1960s, had a critical politics behind its discourse. Situationists claimed the necessity not to precisely delineate stable continents, as done by old maps and aerial photographs. To the movement, the geographical or economic factors could only determine an area when articulated with the representation that its inhabitants have from themselves and that the others have from them. "From a dérive point of view cities have psychogeographical contours, with constant currents, fixed points, and vortexes that strongly discourage entry into or exit from certain zones" (Debord 1958, p. 1). Situationists generated psychogeographical maps to analyze this totality of everyday life by the adoption of a passive movement through space. In a 'mapping- while-wandering' without all the usual motives for action, the drifting strategy let the terrain and the attractions encountered on the way guide the exploratory journeys taken in public space.

Tuters & Varnelis (2006) correlates the mapping practices carried out by artists working with locative media to the twin techniques inaugurated by the French movement in the 1960s. Some annotative projects, in a détournement, annotate social, cultural, historical or political data in the landscape of the city. Other projects, moved by psychogeography or *dérive* tactics, take the technology to stimulate people to walk or occupy public spaces. Artists working with locative media share some of the spatial concerns that founded the Situationism ideas, as the re-appropriation of the city for active inhabitants (McGarrigle, 2010). Though operating in an exploratory form with the adoption of experimental methods of navigation in the cities, a significant period separates from now the context of the sixties in which Situationism gained prestige. At that time, the French movement represented a program of unitary urbanism devoted to subverting the functionalist grids of modernist city planning. This supposed neo-Situationism enabled by context-aware technologies also demand: "social subversion, psychic deconditioning, an aesthetics of dissident experience" (Holmes, 2004, p. 2).

The revolt against the bureaucratic rationalism translates today into the artistic adoption of satellite positioning technology to add a personalized sense of place to location. The first artists to creatively employ locative media wanted to combat the sense that our experience of place was disappearing in late capitalist society (Hemment, 2006). They took art to the streets and suggested a re-embodiment of ourselves. As Southern (2016) analyses, "locative awareness" in the current mobilities paradigm of Social Science also includes the production of social connections in proximate and distant locations; the articulation of networks and databases in a flow of information; the creation of hybrid and multiple perspectives through experimental and social encounters.

Ambiguity as a response to a Neocartesianism

In *Ambiguity as a Resource for Design,* Gaver et al. (2003, p. 233) remember that "the everyday world itself is inherently ambiguous: most things in it have multiple possible meanings". Impelling people to interpret situations for themselves can be so an aesthetic opportunity. As the authors argue, in Human Computer Interaction research and development, usability and usefulness are twin goals, but ambiguity on the other hand is also a rich aesthetic and conceptual potential. It can support deeper and more personal relations with the meanings offered in an interactive system. Ambiguity can generate an experience that is "intriguing, mysterious, and delightful" (Gaver et al., 2003, p. 233). Moreover, it can provide the grounds for people of different sociocultural backgrounds to find their own interpretations from the interaction and information conveyed by the system (idem, p.233).

This paper discusses how the relevance of such possibilities present in the adoption of ambiguity as a resource can gain particular nuances when extended to the design of artworks supported by context-aware technologies. The mapping perspective of artistic projects with pervasive media received several criticisms precisely because they brought a Cartesian determinism revival after many decades of postmodern critique to it (Tuters & Varnelis 2006; Holmes, 2004). The mapping practices can turn into a pure residue of the coordinate system with a reductive understanding of spatiality, wich risks to generate distance from physical and contextual embodiment (Hemment, 2004). It happens, for instance, when surveillance put an excessive and abstract emphasis on location instead of real engagement with people in the mapped area.

Deviate a communication technology designed to impose a rigid cartographic grid upon the world would involve an effort to make people engage not only in location but also in context. "Place-making practices", as defined by Cornelio & Ardevol (2011), contest urban cartographies and demonstrate particular relations with space by including meaningful and personal content to geographical maps. The creation of these "subjective cartographies"

emphasizes the contrast between abstract and lived space. To Southern (2016), "location awareness" in these days embraces:

> the way that the world is experienced through the senses and in situated action; mobile awareness, experienced through movement; a relational awareness of place brought about by social and participatory interactions that are performed and through which location is enacted; an awareness of networks that are connected to presence in space and that extend that presence; an experimental awareness, the process through which actions test, explore, observe and critique in location; and an awareness of the multiplicity of perspectives that we inhabit. (Southern, 2016, p. 181)

Engaging on a political aesthetics in the current days would demand a perspective that also evidences the intrusive and totalitarian character of pervasive media. A "metaphoric critique of advancing ubiquity" to a technology that can mutually represent personal freedom and institutional control, as described by Rieser (2011), should include the possibility of creating a de-centered and subtle mapping. Extrapolating static descriptions is, to McCullough (2006), an imperative to include in the agenda of projects working with global positioning systems and a situated semantics. Though the street grid geographic representations provide the top-level orientation, the context of the monitored places is dynamic.

Ambiguity with contextual and aesthetic meaning can so work as a response to the urge to determine correspondence in Neocartesianism artistic practice. A possible "locative dystopia", as described by Hemment (2004), would respond by playing of distortion rather than reducing space to a set of geographic coordinates. Artists can use ambiguity in metaphors of mapping that put less emphasis on the point-to-point correspondence and more prominence to the disruption of a norm. An artistic experience that critically approaches the clinical precision of digital tracking "results not in a singular totalising view, but in multiplicity and the heterogeneity of the local, not in giving everything its proper place but in mobility, opening up rather than pinning down" (Hemment, 2004, p.2).

The error present in an unambiguously designation or assignment of location may introduce disturbance in the dominant logic of representation. It works in a contrary direction of the objectifying gaze of Cartography and a constrained understanding of spatiality. "Such forms of cultural production can create distortions or moments of ambiguity by which mechanisms of domination become both apparent and less certain" (Hemment, 2004, p.2). The creation of interpretative ambiguity is an aesthetic and conceptual potential. As Gaver et al. (2003) observe, "ambiguity is not a virtue in itself, nor should it be used as an excuse for poor design. Many ambiguous systems are merely confusing, frustrating, or meaningless" (Gaver et al. 2003). To them, however, the ambiguity of information can be applied to a good effect to encourage interpretative engagement and open up space for diverse possible interpretations.

Chronica Mobilis

Chronica Mobilis frames the shifts and consequences that an urban "renew" has been causing in the district of Poblenou, in the city of Barcelona. The project 22@Barcelona claims that it will transform "two hundred hectares of industrial land of Poblenou into an innovative district offering modern spaces for the strategic concentration of intensive knowledge-based activities. This initiative is also a project of urban refurbishment and a new model of city"[3]. Gentrification is the central conflict of a fictional narrative embedded in *Chronica Mobilis*, which is responsible for triggering a series of events in the performance. The narrative follows a network structure, like a spatialized database composed of twelve geolocated video scenes. Places in Poblenou neighbourhood function as locative nodes with this virtual fictional layer added to it. The videos simulate memories of that place through the eyes of a resident.

Those joining the artwork are invited to both: to explore that urban area to find such embedded story and to surveil an exploratory experience in that neighbourhood. The performance happens simultaneously inside an exhibition space and in the city streets[4]. On computers connected to the Internet, online participants monitor and guide the performance of other participants navigating in the cityscape labyrinth with mobile phones. The artistic practice generates multiple layers of meaning to represent the chosen territory, what contrasts the abstract but clinical mapping of locative media to the agency participants have to explore and report their experience of that place.

Psycogeographic practices to define Location

Chronica Mobilis explores the convergence of digital data and physical location using the geographical space as an extension of the performance. The project reinforces the relations between site, story, and participants by creating an embodied experience rooted in particular, lived and shared places and moments. Immersive and compelling experiences can result from such dialogue, making participants engage with the space mapped for the diegesis,

[3] http://www.22barcelona.com/

[4] *Chronica Mobilis* takes as reference works of the British group *Blast Theory*, in which they experiment with the possibilities of integration between physical and virtual spaces, as done in *Can You See Me Now* (2001) and *I Like Frank* (2004).

which could be the original location where the represented fictional events happened.

To create a connection with the space in which participants experience the artwork, the design process of the performance started with some exploratory journeys in Poblenou. Following the premises of the Situationist *dérive* (Debord, 1965), the artists took unplanned drifts in the neighborhood to discover the emotions and behaviors that would come in response to that context. The objective of these psychogeographical practices was to look different to that space and feel the life in there. Drifting around the neighborhood by playing of getting lost, some local scenes serve to a later phase of determining locations to geolocate the scenes of the embedded story. In a more advanced stage, the goal of these explorations was to experiment possible routes participants would take in the geolocated experience.

Figure 1: The geolocated narrative content in Poblenou district.

Poblenou and all its elements inside the framed arena play a central role in the storytelling, becoming part of the diegesis and integrated to it in a meaningful way. The chosen places evoke the atmosphere brought by the story as they resonate the contested "progress" and evidence the contrast between the new and the old. These connections and correlations between both layers of meaning intended to blur somehow the line on participants mind that separates fiction from reality. In *Chronica Mobilis*, the reality of Poblenou and the virtual layer of content added to the district establish a productive dialog because the narrative has much of the current situation lived by Poblenou residents. Even the signs present in the own environment evidence such reality. When taking part in *Chronica Mobilis* and following its embedded narrative, participants experience Poblenou through the lens of the story's character.

Turning Participants into Storytellers

Chronica Mobilis is a navigable story triggered by participant movement through an explorative journey in Poblenou district. The performance places participants in the physical locations where the story events happened by using mobile and locative technologies as a delivery mechanism for storytelling. Whether the spots participants visit are predefined, the path they take to reach the target places is chosen by them. Exploring this story maze, participants have the opportunity to exercise and expand their agency (Murray, 1997) in individual and collective ways, taking decisions and waiting for the outcomes of their acts. They play as a story engine, walking through a network of data elements, visiting the target places, and retrieving the story fragments. To reaffirm even more the connections between site, story, and participants, the latter have also the freedom to self-report their experience of that space. The interaction model of the performance enhances the sense of personal control by letting participants build their parallel story based on their actions.

An app running on mobile devices participants carry with them implicitly collect their position and displacements in the urban space. These geographical coordinates are updated in real time on a map, what enables the drawing of lines, which should precisely indicate participants trajectories through the city. This location data generates the image of a map. Rather than Cartesian, it is a psychogeographic representation of space resulted from the exploration done by the field team. Participants in the streets also report their experience in the city using mobile phones for streaming audio and video. The audiovisual content recorded outside gives a more concrete tone to their experience in Poblenou. The videos are a representation of the environment from the participants' perspective. In their navigation, they have to look in detail to the environment, report and share what they see, hear, and witness. While they have their body senses activated to the interaction with a physical world full of connotative and denotative meanings, they are also producing these diverse information sources.

Those online, on the other hand, have a virtual experience of that location. They monitor and guide the performance of participants in the streets based on the information provided by the geospatial technology. They have complementary layers of meaning to understand the territory. The audiovisual contents are one of these sources. The other is a document with information that comes as memories, full of descriptions regarding the location. The imaginative use of the landmarks in the memories suggests participants an alternative way of looking at the location.

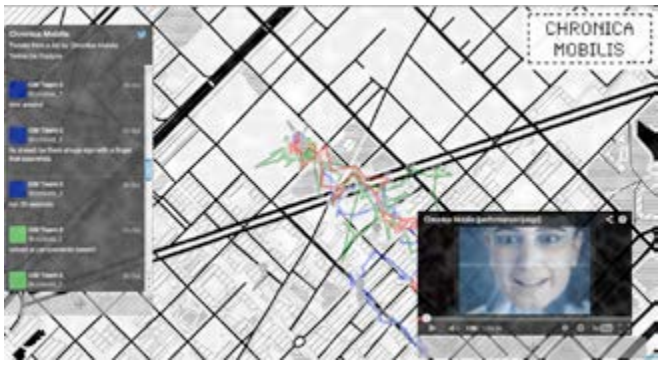

Figure 2: The layers of content in reference to location.

The performance dynamics requires participants to combine all the available layers of content to interpret location and to guide those in the streets in their search for the target places they have to visit. This guidance happens through text messages, in a one-side communication that must be precise because the system restricts the content to 140 characters. Whether the messages are short, they come in a high volume and refer to the exploration of Poblenou district.

Experimenting Uncertainty and Ambiguous Space

Chronica Mobilis adopts different tactics that emphasize uncertainty. Gaver et al. (2003) mention some these modes that artists can adopt to create ambiguity. They can use imprecise representations by exposing inconsistency between sources of information, can display information that is physically or conceptually blurred, or can even juxtapose incompatible elements requiring viewers to build their own meanings from what is displayed.

Chronica Mobilis integrate various and somehow ambiguous layers of data that describes and represents the physical space participants experience. Moreover, it emphasizes ambiguity by putting into question an expected geographical precision of locative media. The imprecision of GPS data creates uncertainty about whether the cartographic representation corresponds to the complexity present in the physical world. "From this point of view, ambiguity provides a frame of reference that allows the use of inaccurate sensors, inexact mappings, and low-resolution displays because it encourages users to supplement them with their own interpretations and beliefs" (Gaver et al. 2003, p. 240).

In *Chronica Mobilis*, the abstract image drawn on the map becomes figurative with the videos recorded by participants in the streets. As Gaver et al. (2003) analyses, practices that explore such possibilities can go beyond the limits of the technology supporting it to create an engaging and thought-provoking experience of location. Those engaged on these practices will see themselves questioning the truth of an accurate system, even though the general view in Human-Computer Interaction is to consider it as an anathema (Gaver et al., 2003). Ambiguity can let a room for personal interpretations, which can vary according to different sociocultural backgrounds.


Figure 3: Online participants monitoring the others in the streets.

Immediately after the presentation of *Chronica Mobilis*, participants completed a questionnaire with open-ended questions that served as an essential mechanism to the understanding of their experience. Qualitative data gathered from the self-reporting answers give an idea about their interaction with the system, the content, and space.

Online participants evaluated their tracking activity as enjoyable, mainly because the performance dynamics demanded collaborative strategies in teamwork. On the system level, they described positively the infrastructure, the presentation based on the combination of multiple sources, and the use of geolocation data. They also mentioned the accessible nature of the media employed, or the "easy technology" as one of them described. As a negative aspect, the main complaint concerned the system level. Online participants complained about the delay and inconsistency of the tracking system, what also occurred because of the low bandwidth connection of the 3G networks. As they could not only trust on the tracking made by locative media to define position, they have to trust on the representation and self-report information sent by participants in the streets. They complained about the technology evidence how they judge and rely on the clinical precision of pervasive systems. Even though they did not mention a possible richness in the ambiguity created by the diverse layers of content, they evaluated their online experience of Poblenou as "motivating", "exciting", "intriguing".

Another relevant aspect identified on the questionnaires

is the manner participants in the streets evaluated their experience. They rated as positive the feeling of agency, what they understood as an opportunity to freely create their own story based on the exploration of Poblenou. Wrote one participant: "It felt like being a documentary, reporter creator [sic]". This participatory cartographic practice proposed by *Chronica Mobilis* comes as an empowering aspect of the mapping strategy, whose potential resides in participants agency to self-positioning themselves in location. What they share are spatial biographical narratives based on their exploration of Poblenou, a participatory process that enables participants to position and map the self (Sotelo-Castro, 2010, p. 593).

Among *Chronica Mobilis* participants, the sense of adventure in discovering the sites within the real city appeared as one of the recurrently referred aspects. Some mentioned how they felt responsible for the performance; others pointed to the amusing ludic dimension of exploring that place. In *Chronica Mobilis*, the gentrification signs in Poblenou neighbourhood appear on the representation made by participants, rather than on the abstract mapping made by locative media.

Conclusion

This paper discussed artistic practices that employ navigational technologies claimed to determine with clinical precision people's placing and dislocations. Though it represents a primary source to the proposal of more embodied interactions, a significant concern also arises from such surveillance. This paper identified that the monitoring process made by military technologies could represent an impasse when artists reduce the practice to a Neocartesianism discourse.

Chronica Mobilis goes beyond the relations between physical movements and its virtual screen-based representation on a rigid cartographic grid and its coordinate system. Instead of creating distance, the performance employs pervasive media to generate proximity with the local context. Connectivity and virtual interactions, in this case study, collaborate to a consistent engagement of people and place. The artwork invites participants to take a critical or reflexive incursion in the city. Converted into storytellers, they enunciate their experience of Poblenou neighbourhood. Ambiguity and inconsistencies between a technological and a self-mapping appear in *Chronica Mobilis* as a proposal to critically approach pervasive technologies' idea of clinical precision and greater power to reach and control location.

References

Cornelio, G. S., & Ardévol, E. (2011). Practices of place-making through locative media artworks. *Communications*, *36*(3), 313-333.

Debord, G. (1958). Theory of the Derive', Internationale Situationist# 2. *Knabb, Ken. Situationist International Anthology*.

Gaver, W. W., Beaver, J., & Benford, S. (2003, April). Ambiguity as a resource for design. *Proceedings of the SIGCHI conference on Human factors in computing systems,* 233-240.

Hemment, D. (2006). Locative arts. *Leonardo*, *39*(4), 348-355.

Hemment, D. (2004). The locative dystopia. Retrieved from http://eprints.lancs.ac.uk/30831/1/Locative_Dystopia_2.pdf

Holmes, B. (2004). Drifting through the grid: psychogeography and imperial infrastructure. Retrieved from http://www.springerin.at/dyn/heft_text.php?textid=1523&lang=en

Jenkins, H. (2004). Game design as narrative. *Computer*, *44*, 53.

McCullough, M. (2006). On Urban Markup: Frames Of Reference In Location Models For Participatory Urbanism. *Leonardo Electronic Almanac*, *14*(3), 4.

McGarrigle, C. (2010). The construction of locative situations: locative media and the Situationist International, recuperation or redux?. *Digital Creativity*, *21*(1), 55-62.

Murray, J. H. (1997). Hamlet of the Holodeck- The future of narrative in cyberspace.

Pinder, D. (2013). Dis-locative arts: Mobile media and the politics of global positioning. *Continuum*, *27*(4), 523-541.

Southern, J. (2015). Locative awareness: a mobilities approach to locative art. *Leonardo Electronic Almanac*, *21*(1), 178-191.

Rieser, M. (2011). Beyond Mapping: New Strategies for Meaning in Locative Artworks. In Rieser, M. (Ed.), *The mobile audience: media art and mobile technologies*. Amsterdam-New York: Rodopi, pp.127-140.

Sotelo-Castro, L. C. (2010). Participation cartography: blurring the boundaries of space, autobiography, and memory by means of performance. Research in Drama Education: *The Journal of Applied Theatre and Performance*, *15*(4), 593-609.

Tuters, M., & Varnelis, K. (2006). Beyond locative media: Giving shape to the internet of things. *Leonardo*, *39*(4), 357-363.

Authors Biographies

Vanessa Santos is a digital media artist and researcher. She holds a Ph.D. in Social Communication (2017), from Pompeu Fabra University. Her expertise is in audiovisual production, digital storytelling, interactive systems, locative and mobile media. She has collaborated with research groups involved in the study of the following topics: technology inclusion, socio-tech networks, open source software for multimedia production, virtual and augmented reality based systems to experience complex data sets. The artist is interested in the creative use of technology and in the stimulus that it entails in the formulation of new narrative genres. In 2014, she integrated the research line on Locative Media of *Hangar Center for Visual Arts*. Her last work is “Chronica Mobilis”, an interactive and geolocated performance with gameplay, which happens in a public space. Currently, she investigates the audience experience in response to different modes of engagement.

An emerging role for design methods in transdisciplinary practice

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Abstract

This paper is a follow up to some of the authors' ISEA 2017 paper "Towards an inventory of good practices for transdisciplinary collaboration." A key issue identified there was how to develop training methods for teams that bridge very different research, development and assessment methodologies. In this paper, we propose design methods to improve transdisciplinary collaborations, with a particular discussion on the emerging community of practice that seeks to enable art-science collaboration. An ISEA workshop is also proposed to make explicit the methodologies described.

Keywords

ArtScience, design methods, transdisciplinary collaboration, education, training

Introduction

A contemporary dichotomy in western, and other, academic and industry circles is articulated between science-engineering and art-humanities. This dichotomy can take different forms; for example, hard and soft, quantitative and qualitative, logical and creative, objective and subjective, and so on. Many of these are false, or oversimplifying, dichotomies or reductionist thinking that have lessened our human ability to solve complex problems. These dichotomies are not new. As pointed out by Davis (2018), the Roman polymath Marcus Vitruvius Pollio advocated many of the holistic approaches being debated today.

Nonetheless, some new integrative thinking has emerged to counter this current artificial reductionism in today's digital culture. For example, the 'STEM to STEAM' movement seeks to develop initiatives that integrate the arts, design, and humanities with science, technology, and medicine (e.g., Malina, Strohecker, & LaFayette, 2013). However, there is a clear need to develop new methods for transdisciplinary collaboration that take into account todays digital culture context (Mejia, Malina, & Roldán, 2017, p. 685). In this paper, we reflect on the use of design methods to improve transdisciplinary collaborations in order to overcome the chiasm and biases of these false dichotomies.

Within that framework and for the purposes of this paper, transdisciplinarity entails not only crossing disciplinary boundaries but also crossing sectors of society to include all the stakeholders involved or affected by an issue (Repko, 2007, p. 15). Within this approach to transdisciplinarity, design practices are particularly relevant because they are concerned with 'doing' to solve problems combining different activities, which sometimes are related to art and sometimes to science. Thus, using design methods in collaborations between researchers and citizens helps to focus not only in the social appropriation of knowledge but also in addressing problems that are pressing in place based territories.

Scholars, for long, have discussed whether the design practice is an art or a science. For example, in Calvera (2003) authors debated the relationship between art and design. Arguably, design is both art and science. Some authors have strongly contended that design practice is different from science to avoid the common confusion that scientific research methods can be used to solve design problems (see Krippendorff, 2007). In this paper, we discuss how design methods incorporate mindsets and techniques from both art and science, such as embedded observation borrowed from ethnography and sociology, or fast prototyping that echoes of sketching by visual artists. This integrative designerly approach leads us to propose that design methods are a potential tool for transdisciplinary collaboration.

Art and science, Art Science, ArtScience, Sciart (and more…)

For the past several hundred years, the paths of artistic expression and scientific endeavor have diverged increasingly, prompted by developments within academia and industry (such as the appearance of disciplinary departments of study and the division of labor, respectively). Moreover, the

divergence kindled the philosophical questions of "what is (good) art?" and "what is (good) science?", further separating the two in ways that have led to a profound difference of identity between scientists-engineers and artists-humanists despite their similarities in practices and philosophies (Leach, 2011, pp. 144-146).

For the authors, art has the following general characteristics:

- Art, like design and science, is a creative endeavor.
- Artists try to change the perception of humans through attaching meanings to experiences.
- There is research in art and design, which is similar to research in science.

For the authors, science has the following characteristics:

- Science is the human activity which seeks to understand causal mechanisms in phenomena that can be observed by humans.
- Scientists seek to produce knowledge and understanding that are not biased by the human cognitive apparatus.
- Scientific research seeks to predict things that happen in the world.
- Engineering, design, and other applied sciences use design methods.

Although art and science seem to be identifiable categories, some human activities are ambiguous or integrative. For Strosberg (2015), art and science today often share the same tools and materials and technology becomes their main connection (p. 23). Frayling (1993) argued that there is not much difference between art and science. He said that the history of institutions and media has shaped stereotypes that have mistakenly separated art and science practices; for instance, in their practice, artists do research activities and scientists do creative activities (p. 3). For these reasons, integrating artists and scientists in collaborative work is a cultural and institutional challenge rather than a technical one.

Recently, some universities are increasingly offering academic programs and research in art and science. One example, in which some authors are affiliated, is the ArtSci Lab at the University of Texas at Dallas. ArtSci lab states that "[they] are a transdisciplinary research lab—helping the arts, science, and technology communities by pursuing initiatives of societal urgency and cultural timeliness;" one of the used methodologies is designing projects with collaboration between artists and scientists from the inception. In France, initiatives such as the SACRE PhD program (https://collegedoctoral.univ-psl.fr/doctorat-psl/programme-doctoral-sacre/) trains PhD students across art and science disciplines. The Carasso Foundation (http://www.fondationcarasso.org/fr/event/la-chaire-arts-sciences) also recently created the first university chair in Art Science bridging disciplinary institutions.

One critical issue that justifies the need for arts/humanities and science integration is the recognized demand that science and technology should not be separated from social practices and belief systems in human groups. In the Frankfurt School, science had a social function, which means that scientific problems are expected to respond to a collective interest (Horkheimer, 1998). Helga Nowotny, former President of the European Research Council, has called for 'socially robust science' (Nowotny, 2003, p. 151-153). The multiples initiative of art and science in their different flavors all aim to tackle the demand for social-centered ways of knowing.

Design methods

One of the core issues in the history of design methods is the tension between intuition and rationality. Design education in Europe and the US originated in art and craft schools; thus, designers relied primarily on creative intuition and implicit knowledge. In the early 20th century, western design education was based on the master-apprentice model, in which novice-students practiced in studios with expert-instructors to learn design crafts. Some traditional learning techniques include analyzing exemplars, sketching, prototyping, and critiques. These techniques are based on intuition because little evidence from the real-world is used for decision-making. In the 1960's, the design methods movement appeared, and several of its proponents, such as early Christopher Alexander advocated for rational methods in design to address the increasing complexity of design problems (Alexander, 1964, pp. 8-11). Soon, the excitement about more logic and less intuition in the design process was questioned by Alexander himself and others; in the 1970's, 'second and third order' design methods emerged exploring the participation of the users in the process and revisions about the role of intuition in design thinking (Cross, 1984, pp. 303–307). Particularly, the work of Rittel showed that rational approaches from engineering and science are insufficient to address 'wicked' problems of planning because these problems are ill-defined and elusive (Rittel & Webber, 1973, p. 160). The discussion between rationality and intuition is also present beyond design; for instance, within the cognitive science communities researchers now seek ways to 'train' intuition and imagination (see http://www.cognovo.eu/)

A seminal work in design thinking is the book *Designerly ways of Knowing* by Nigel Cross, which positions design as a third 'culture' different from both (a) arts and humanities and (b) science. He suggested that designerly thinking is an alternative different from artistic and scientific thinking (Cross, 2006, p. 018). For example, he said that whereas scientists use analysis to solve problems, designers use synthesis. Cross explained:

> *The designer is constrained to produce a practicable result within a specific time limit, whereas the scientist and scholar are both able, and often required, to suspend their judgments and decisions until more is known – 'further research is needed' is always a justifiable conclusion for them (p. 023).*

Nigel Cross (2006) distinguished between scientific, artistic/humanistic, and designerly ways of knowing to capture the idea that different disciplines use different research and development methodologies to make sense of the world, its

phenomena and its processes. Each discipline develops different evaluation methodologies to assess what is more or less "good" within its own approach. Cross noted differences between the sciences, arts/humanities, and design in the phenomenon studied, the appropriate methods, and values (see table 1).

Table 1. Cross' ways of knowing

	Sciences	**Arts/ Humanities**	**Design**
Phenomenon of study	The natural world	Human experience	The artificial world
Appropriate methods	Controlled experiment, classification, analysis	Analogy, metaphor, evaluation	Modelling, pattern-formation, synthesis
Values of each culture	Objectivity, rationality, neutrality, and a concern for 'truth'	Subjectivity, imagination, commitment, and a concern for 'justice'	Practicality, ingenuity, empathy, and a concern for 'appropriateness'

A practical, well-known, and contemporary design method is the double-diamond model (The Design Council, 2014). In Figure 1, the left sides of the diamonds represent divergent thinking and the right sides represent convergent thinking. In this model, the Discover phase can be associated to rational research processes; however, design research is often conducted under time constraints that force a flexibility in the validity of data and the goal is to inform design-decision making instead of the generation of scientific knowledge. Also, the Develop phase can be associated with intuitive artistic processes. There is intuition in the process, but a difference is that the goal is to find a satisficing practical solution not to seek the sole subjective expression of the designer.

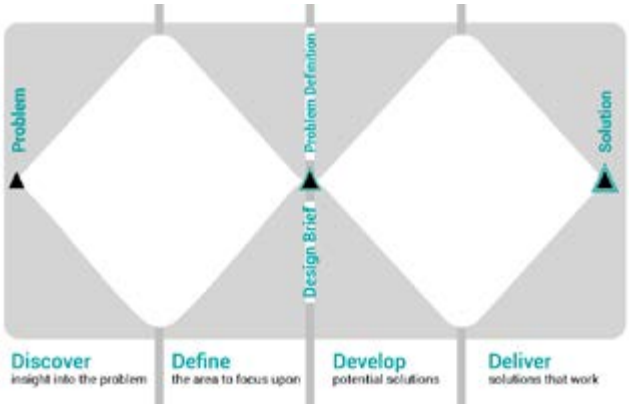

Figure 1. Adaptation of Design Council's double-diamond model. Design by Luana Carolina and João Silveira

Christian Rohrer's *Landscape of User Research Methods* (2014) proposes a visualization of the landscape of design methods within two axes: attitudinal and behavioral, and qualitative versus quantitative (see figure 2). These are more methodological tools that can be implemented depending on the situation and designer's decisions. The methodological tools on Rohrer's landscape have various purposes depending on the needs and phases of the project. Some tools are generative, used in early ideation; exploratory, for concept generation and understanding criteria; or evaluative, testing of the system. The process and methods of design described above allow designers to create possible futures, much of which would not come to be naturally.

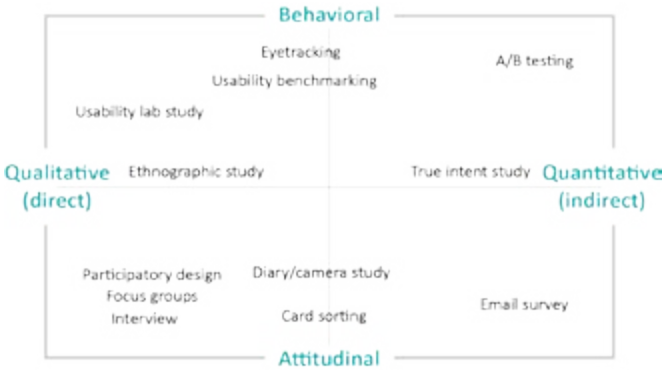

Figure 2. Adaptation of Rohrer's grid, showing some popular methodological tools of design

A recent approach in the field is codesign. It is a collaborative design practice in which two or more designers, or participants from different disciplines, come together in an articulated and integrated manner to design products and services. Sanders and Stappers (2008, p. 2; 2012, p. 30) define codesign as a specific instance of cocreation in which collective creativity is applied throughout the design development process. Collective creativity refers both to the set of creative qualities that the design proposal entails and to the creativity of the tasks carried out as part of this process (Yu, Nickerson and Sakamoto, 2012, p. 1). The codesign method is a place for the negotiation of ideas and approaches according to the knowledge, arguments, and points of view of the participants, their qualities directly influence the decision-making process (Jin and Geslin, 2008, p. 494; Klein et al. ., 2003, p. 201). The collaborative approach in codesign makes it a particular design method of interest for training people in transdisciplinary collaboration, even when the goal is not to design a product or service (e.g., designing the structure of a collaboration).

Design methods as a good practice for transdisciplinary collaboration

In the design methods section above, it is shown that design (thinking and methods) is a way of knowing different from art and science. However, design methods also incorporate

artistic and scientific activities within several steps. We argue here that the use of design methods is and can be a potential good practice for transdisciplinary collaboration. In this context, we understand transdisciplinary practice as a unifying fusion of disciplines, in which it is not possible to distinguish a single discipline in the process and outcome (Pombo, 2008, p.14-15). The rationale is based on the idea that the design field already struggled, historically, to develop methods and proved that neither artistic or scientific thinking alone were sufficient to address complex social wicked problems, which are the type of problems often addressed in transdisciplinary collaborations.

Design methods have been applied not only to design physical artifacts but also for intangibles like services and collaborations. High order design problems such as interactions, services, environments, and systems (see Buchanan, 1992) need more thoughtful methods and processes that usually involve the participation of different stakeholders and collaboration among designers, other disciplines, and users. Increasingly design problems are addressed by transdisciplinary teams and have shown successful integrations of diverse designerly ways of knowing (e.g., Brown, 2007). Solving problems using design methods is a potent practice to facilitate transdisciplinary collaborations. For example, transdisciplinary projects aimed for innovation tend to turn the participants into problem-solving designers, which has been the exemplary case of Aerocene, a transdisciplinary collaborative effort to accomplish lighter-than-air travel, and of IndaPlant, an attempt at merging robotics and plants to automate biodomes (Garcia Topete, Malina, Strohecker, & Thill, 2017, p. 6).

Transdisciplinary collaborations involve professionals with very different, though overlapping ways of knowing. We have argued that one of the benefits of transdisciplinary collaborations is to draw on different ways of knowing to overcome limitation and biases inherent in each when appropriate, but also to benefit with alternate methodologies. We argue against the idea of simple 'consilience' (Wilson, 1999) as a way of integrating together different ways of knowing, but draw on Slingerland and Collard's concept of using integrating methods in different ways depending on scale in time, size, or other metrics of phenomena or problems being addressed (Slingerland & Collard, 2011). We argue that design methodologies are an appropriate approach to designing transdisciplinary collaborations (which may or may not in themselves involve designers as one of the disciplines, and may or may not be about designing a product or service as the outcome of the collaboration).

Reflecting on the idea of transdisciplinarity as crossing boundaries in sectors of society (Repko, 2007), design methods can be a strategy for collaborations between citizens and experts. A potential role of design is to dynamize the social appropriation of artistic and scientific knowledge. Design itself is moving towards more collaborative approaches to solve problems and create complex sociotechnical systems.

It can be argued that a major weakness of design practitioners is the lack of reflective practice, which is critical in the flow of transdisciplinary collaboration. Most design processes often omit (or at best tacitly include) reflection as a needed part of the process. Schon's model of reflective practice can enable double-loop learning (Argyris & Schon, 1978), where the mental models and views of the world can be refined, updated and changed based on new understanding of the world. Reflective practice is particularly relevant when working with a transdisciplinary group that sometimes have varied understanding and viewpoints of the world.

The issue of how to train professionals engaged in transdisciplinary projects is rising in importance. For instance, at the University of Texas at Dallas, under the leadership of Dean Anne Balsamo a new masters in how to teach in ways that embody "STEM to STEAM' concepts is under development; this work draws on Balsamo's research such as *Designing Culture: The Technological Imagination at Work* (2011). The SACRE PhD in Paris, cited above, is a different approach. Key issues involve identifying and transferring implicit knowledge between different disciplines using apprenticeship methodologies, and experimental publishing methodologies for knowledge capture (e.g., Hall, Bermell-Garcia, Ravindranath, & McMahon, 2017).

In addition to the paper proposed by the authors, a proposal for an ISEA workshop has also been submitted. The authors look forward to collaborating with the ISEA community of practice in developing good training methods for transdisciplinary collaborations.

References

Alexander, C. (1964). *Notes on the Synthesis of Form*. Harvard University Press.

Argyris, C., & Schon, D. A. (1978). *Organizational Learning: A Theory of Action Perspective*. Reading, MA: Addison-Wesley.

Balsamo, A., (2011). *Designing Culture: The Technological Imagination at Work*. Durnham, NC: Duke University Press.

Buchanan, R. (1992). Wicked Problems in Design Thinking. *Design Issues*, *8* (2), 5–21.

Calvera, A. (Ed.). (2003). *Arte¿?Diseño: Nuevos capítulos para una polémica que viene de lejos*. Barcelona, Spain: Gustavo Gili.

COGNOVO. Cognitive Innovation Program. http://cognovo.eu/ (jan 20 2018).

Cross, N. (Ed.). (1984). *Developments in design methodology*. New York, NY: John Wiley & Sons.

Cross, N. (2006). *Designerly ways of knowing*. London, UK: Springer.

Davis, J. (2018) Unification of Knowledge. *Leonardo Journal*. In press.

Frayling, C. (1993). *Research in art and design* (Vol. 1). London, UK: RCA Research Papers.

Garcia Topete, A., Malina, R., Strohecker, C., Thill, R. (2017) SEAD Exemplars: Evidence of the Value of Transdisciplinary Projects. SEAD Committee. Retrieved

from https://seadexemplars.org/wp-content/uploads/2018/01/SEADExemplarsReport-December-2017.pdf

Hall, M., Bermell-Garcia, P., Ravindranath, R., & McMahon, C. (2017). Lessons learnt from experts in design rationale knowledge capture. In A. Maier, S. Škec, H. Kim, M. Kokkolaras, J. Oehmen, G. Fadel, … M. Van der Loos (Eds.), *Proceedings of the 21st International Conference on Engineering Design (ICED 17)* (Vol. 6 Design Information and Knowledge, pp. 247–256). Vancouver, Canada: The Design Society.

Horkheimer, M. (1998). *Teoría Crítica* (2nd ed.). Buenos Aires, Argentina: Amorrortu Editores.

Jin, Y., & Geslin, M. (2008). Roles of negotiation protocol and strategy in collaborative design. In J. S. Gero & A. K. Goel (Eds.), *Design Computing and Cognition'08* (pp. 491–510). Dordrecht, Netherlands: Springer.

Klein, M., Sayama, H., Faratin, P., & Bar-Yam, Y. (2006). The dynamics of collaborative design: Insights from complex systems and negotiation research. In D. Braha, A. Minai, & Y. Bar-Yam (Eds.), *Complex Engineered Systems. Understanding Complex Systems* (pp. 158–174). Berlin: Springer.

Krippendorff, K. (2007). Design research, an oxymoron? In R. Michel (Ed.), *Design research now. Essays and selected projects* (pp. 67–80). Basel, Switzerland: Birkhäuser.

Leach, J. (2011). The Self of the Scientist, Material for the Artist: Emergent Distinctions in an Interdisciplinary Collaboration. *Social Analysis*, *55*(3), 143–163.

Malina, R., Strohecker, C., & LaFayette, C. (2013). *Steps to an Ecology of Networked Knowledge and Innovation: Enabling New Forms of Collaboration among Sciences, Engineering, Arts, and Design* (SEAD). MIT Press. Retrieved from http://www.mitpressjournals.org/page/NSF_SEAD

Mejia, G. M., Malina, R. F., & Roldán, A. F. (2017). Towards an inventory of best practices for transdisciplinary collaboration (pp. 681–687). Presented at the 23rd International Symposium on Electronic Arts ISEA2017, Manizales, Colombia: Universidad de Caldas.

Nowotny, H. (2003) Democratising expertise and socially robust knowledge. *Science and Public Policy 30* (3), pp. 151–156.

Pombo, O. (2008). Epistemologia da interdisciplinaridade. *Ideação, 10* (1), pp. 9-40.

Repko, A. F. (2008). *Interdisciplinary Research: Process and Theory*. Thousand Oaks, CA: SAGE.

Rittel, H. W., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, *4* (2), 155–169.

Rohrer, C. (2014, October 12). When to Use Which User-Experience Research Methods. Retrieved January 15, 2017, from https://www.nngroup.com/articles/which-ux-research-methods/

Sanders, E., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *CoDesign*, *4* (1), 5–18.

Sanders, E., & Stappers, P. J. (2012). *Convivial design toolbox: Generative research for the front end of design*. Amsterdam, Netherlands: BIS Publishers.

Slingerland, E., & Collard, M. (2011). *Creating Consilience: Integrating the Sciences and the Humanities*. Oxford University Press.

Strosberg, E. (2015). Art and Science (2nd ed.). New York, NY: Abbeville Press.

The Design Council. (2014). The Design Process: What is the Double Diamond? Retrieved December 22, 2017, from https://www.designcouncil.org.uk/news-opinion/design-process-what-double-diamond

Wilson, E. O. (1999). *Consilience: The Unity of Knowledge*. Vintage Books.

Yu, L. L., Nickerson, J. V., & Sakamoto, Y. (2012). Collective Creativity: Where we are and where we might go. Proceedings of Collective Intelligence. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2037908

Experimental Animation, Hybridisation and New Media

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Abstract

This paper seeks to investigate the resurgence of experimental animation in terms of its contemporary redefinition as an expanded and hybrid form of moving image practice, one that moves beyond conventional reception, modes and sites of display and into the realm of new media art. Indeed while experimental animation is enjoying a revival in the animation industry and various film platforms, it is at the same time emerging as an expressive medium within new media art practice. This is partly due to the current dominance of moving practices within visual culture but can also be attributed to its innate interdisciplinary potential. Wells and Hardstaff (2008) acknowledge that a hybrid approach has always been present in experimental animation, but they argue that the digital era has brought this all-embracing characteristic of the genre to the fore because the digital revolution has provided a platform with seemingly endless creative potential (Wells & Hardstaff 2008: 7, 15)

Keywords

Experimental animation, Modernism, hybridisation, new media, digital platform, contemporary art

Experimental Animation, Hybridisation and New Media

The field of experimental animation is traditionally associated with non-linear, non-objective abstract animated film. However, in more recent debates the definition of experimental animation has expanded to include all manner of creative expression concerning the moving image. In particular it has resurfaced in the digital age (from its relative obscurity in the analogue era) as a dynamic hybrid form within contemporary and new media art practice. That experimental animation is an expressive medium that pushes interdisciplinary boundaries has been characteristic of this genre since is early inception at the turn of the 20th century. Innovators of the genre were painters Léopold Survage (France, 1914), Walter Ruttmann (Germany, 1921) and Viking Eggeling (Germany, 1924). They were members of the avant-garde who believed the relatively new technology of film, with its characteristic dimensions of movement, light and projection, paved the way for a new expanded painterly art (experimental animation) that had the potential to "represent the artist's core experience of modernity". Peter Weibel in his essay "The post-media condition" discusses how the emergence of old technological media such as photography and film at the turn of the 20th century exerted a significant influence on traditional artistic media, to the extent that not only were these innovations "a new branch on the tree of art but actually transformed the tree of art itself" (Weibel 2006).

This can be said of the development of early experimental animated film (old technological media), which developed out of a few Modernist artists' desire to engage with the relatively new medium of film and to find a new language and new possibilities for traditional artistic practice. In particular, cinema technology provided a platform for "the move of art into film" (Leslie 2002: 37). According to Esther Leslie in *Hollywood flatlands: Animation, critical theory and the avant-garde* (2002), these painterly experiments in film "surfaced out of the extension of problems posed in the fine arts: how to represent rhythmic processes not just in space and on a flat surface but also in time" (Leslie 2002: 37). The innovative painterly abstract animated films of Walter Ruttman epitomises this approach. Ruttmann, who painted directly onto celluloid, believed that the new technology of film paved the way for a new painterly art (experimental abstract film) that had the potential to "represent the artist's core experience of modernity". To Ruttmann, time, speed

and tempo symbolised the "essence of modernity" and were also central characteristics of his painterly animated experiments which he described in his 1919 manifesto on art as "Malerei mit Zeit" (Painting with Time) (Schönfeld 2006: 172). Ruttmann's first film, *Lichtspiel Opus 1*, opened in Berlin in 1921 (see Figure 1), and featured the abstract movement and rhythm of colour and soft, sensuous marks, synchronised to an original soundtrack. Experimental animation thus not only extended the vocabulary of traditional artistic media but also allowed for the mixing of the media, consequently blurring the boundaries of previously medium-specific genres. However, until recently, these artists and their films faded into relative obscurity or they moved on into other filmic or artist media. This is attributed mainly to the dominance of orthodox animation during most part of the 20the century, and of course due the enormous expense and labour intensiveness of producing animation during the analogue era.

Figure 1. Ruttmann, W. 1921. Still from Lichtspiel Opus 1 [Online] Available: http://www.see-thissound.at/files/60/large/large.jpg?1273514587 (Accessed 3.07.2017)

Another factor that has influenced the resurgence of experimental animation is the democratising nature of digital technology. Experimental animation is largely associated with independent animation. While independent animation production has been in existence since the early 20th century, until the advent of digital film technology the production of independent animated film has mostly been the preserve of a few individuals. This is due to the fact that, before about 1990, making an independent animated film was costly, labour-intensive and technically demanding. Nowadays, with advanced computer technology and animation, editing and stopmotion software, the process of producing an independent animation is cheaper, faster and far less labour-intensive than it was using pre-digital technologies. In addition, computer hardware and software, and digital camera technologies are becoming more and more affordable and thus more accessible to the individual (Simon 2003: xiv). The digital platform and digital technology significantly eases the pain of working with more traditional animation techniques. Accessing animation software not only speeds up traditional hand-crafted animation processes, but also enables one to view and review the movement in progress, for example. Processing, storing and editing individual frames digitally have a significant labour saving impact. Thus animation techniques and approaches that draw on handcrafted media, (such as paint-on-glass, graphic and paint media on paper and paper cut-out animation) are generally greatly facilitated by the digital platform. Of course digital animation has become another form of the medium and is just as easily integrated with hand crafted animation with the assistance of digital cinema technology.

While the interdisciplinary potential of experimental animation has been there since its inception, Pilling points out that the digital platform and new technological media have reinvigorated independent animation by further broadening the scope for it to cross disciplinary boundaries (2001: 7), and making it much more accessible for the independent film maker. Moreover, Weibel claims the one of the most significant impacts of digital technology on creative practice is that it allows for a greater "mixing of the media-specific idiosyncratic worlds of the media" (Weibel 2006). It is thus not surprising that experimental animation is thriving in the digital era because with its innate mixed media approach it is well suited to this aspect of the digital platform. While the digital platform

allows for a greater diversity and extension of creative approaches, it does not necessarily challenge or threaten old approaches with obsolescence. Rather, it becomes an accessible, facilitating and labour-saving tool, making it possible for individuals to use digital and traditional animation processes without the expense, and extra time and labour such processes traditionally require. While this is true for the production of commercial animation aimed at mainstream audiences, it also applies to the production of independent, experimental animations. Pilling notes that the growing interest in independent experimental animation is reflected in the significant rise in animation festivals. Pilling regards the short experimental animation format as an ideal platform for experimentation and research, and animation festivals as the ideal platform for showcasing such films:

> *International festivals are another factor in raising the profile of animation and have mushroomed all over the world reflecting growing audience interest. Short films are the lifeblood of such festivals. Since most animation is the most labour intensive, shorts are often seen as the 'research and development' branch of the industry, a test bed for new ideas, approaches, styles and techniques. (Pilling 2001: 7)*

Figure 2. Landreth. C. 2004. Still from Ryan [Online] Available: https://encirculos.blogspot.co.za/2011/08/100-as-lxvryan-2004-chris-landreth.html *(Accessed 1.01. 2018)*

It is such festivals that have brought innovative experimental animation to the fore – Such as Chris Landreth's documentary animation *Ryan*, which debuted at the Cannes Film Festival in 2004 - a blend of highly sophisticated digital and traditional animation processes, integrating drawing, found imagery, live film 2D and 3D formats. While this film celebrates the traditional handmade animations of Canadian animator Ryan Larkin, at the same time Landreth innovatively engages with the 3D platform as an expansive artistic tool not bound by the conventions of mainstream 3D film (Pixar) (Figure 2.).

While hybridity has been integral to experimental animation since its inception, approaching the genre through the digital platform is relatively new. As with other artistic traditions, the digital platform has further expanded the interdisciplinary potential of experimental animation, from its mixed media fine art and early animation origins to the contemporary assimilation of the medium into new media art. Contemporary Canadian animator, Rose Bond, for example creates site specific installations in urban public spaces which combine digital and hand crafted animation processes. She is concerned with re-defining experimental animation in terms of its hybrid importance to new media, and moving away from traditional sites and modes of viewing. One of her most shown installations, *Intra Muros* (20072015), (figure 3) consists of projected animations in windows of buildings. These installations move the genre out of the cinema space and into the urban landscape engaging passers-by, re-inventing the genre and at the same time introducing experimental animation to the general public. While the installation still has vestiges of animated narrative, echoes and celebrates the experimental processes of early Avant-Garde animators and evokes the cinema screen, it goes further to reevaluate reception, conceptual engagement and exhibition within a new media context. This relationship between new media and animation is becoming increasing accepted as a legitimate development within

contemporary moving image practice - evident in the fact that many film festivals now have a new media category for productions that include film and animation.

Figure 3. Bond, R. 2007. Still from installation Intra Muros (Utrecht's Stadhuis (City Hall), Holland Animation Film Festival 2008 [Online] Available: http://rosebond.com/work/intra-muros-utrecht/ (Accessed 3.01.2018)

Karolina Sobecka's *Wildlife* (Figure 4) similarly denotes this expanded form of moving image practice, but in terms of a shifting setting and a transient experience for the passer by. An animation of a tiger is projected from a moving car onto various urban structures and at various times of day and night. The animation is programmed to correspond to the speed of the car via a sensor – thus as the car slows down so does the tiger. When the car stops the tiger sits. Like Bond's *Intra Muros* evokes the cinema screen in the static framed sequence of windows in buildings, *Wildlife* also refers to the cinema screen in that the car passenger views the works through the car windows. *Wildlife* however while specific to the urban setting is not site specific, *like Intra Muros* - rather the visual projection is moving through space and its constant transformation is determined by the shifting urban setting. Aside from the car passengers and driver, the audience experiences the work as something glimpsed rather than contemplated or watched as a conventional narrative. While presented differently, both Bond's and Sobecka's works challenge conventional sires and modes of reception, without negating the animated traditions they are referring to.

Figure 4. Sobecka. K, 2006, Still from Wildlife [Online] Available: http://www.gravitytrap.com/artwork/wildlife (Accessed 16.01.108)

Jihoon Kim (2009) observes that much experimental animation has not been duly recognised in mainstream contemporary art but is 'celebrated in exhibitions or festivals held in new media contexts' – as with Rose Bond and others such as Karolina Sobecka. But this is tied up with the problematic and complex relationship between the mainstream contemporary art world and that of new media art in general, in particular the failure of new media art to conform to mainstream contemporary art values. Shankin posits that new media art "does not meet the familiar expectations of what art should look like, feel like and consist of …" He goes further to quote Christies contemporary art expert Amy Cappellazzo who notes " collectors get confused and concerned about things that plug in" (Shankin, 2011). Although he points out the recent recognition and value now placed on video art by reputable mainstream galleries and the art market and suggests that there will come a time when 'new media and the longer history of electronic art' will achieve similar recognition within mainstream contemporary art.

The same can be said of experimental animation within the expanded new media context. Although there are exceptions. William Kentridge for example - of global contemporary art fame and arguably South Africa's most successful artist whose collaborative multi-media productions integrate experimental animation along with

performance, music, installation and storytelling, as epitomised in his 2010 multimedia production of *The Nose* based on Russian composer Dmitri Shostakovich's opera of the same name (1927–28) (Figure 5).. Combining musical composition, dance, film projection, animation and puppetry, Kentridge's approach, as seen in this production, embodies the hybridization of media in the contemporary digital age (Shankin, 2011, p 471). His acceptance within contemporary mainstream art could be partly due to his adherence to a linear, conventional narrative format and recognisable fine art traditions and processes.

One artist/animator whose work successfully bridges both the contemporary mainstream art world and new media is Han Hoogebrugge. Originally a painter and cartoonist, he gained notoriety in the 1990s for his *Modern Living/Neurotic*a series. This series began as a semi-autobiographical comic strip which Hoogerbrugge adapted to the Internet, first as animated gifs and later as interactive Flash animations. Hoogerbrugge chose Flash because of its interactive tools and because the vectorbased nature appealed to his stripped-down, Hockney-like drawing style that he uses in the interactive, animated works (Frederiks 2012, np). His acerbic, humorous take on the contemporary human condition emanates in much of his animated work - which ranges from digital interactive online animation to interactive and noninteractive installation and performance. While his creative productions almost always break with traditional modes of viewing and reception even his non - animated drawings, comics and sculptural installations reflect in various ways his engagement with the practice of animation (Figure 6).

Figure 5. Kentridge. W, 2010, Set of Kentridge's multimedia production of Shostakovich's opera The Nose [Online] Available: http://www.nytimes.com/2010/02/28/arts/music/28kentridge.html (Accessed 12. 01. 2018)

The interdisciplinary nature of experimental animation, and its integration of digital and traditional creative processes, negates perceived anxieties (within the traditional creative disciplines) that digital media and the digital platform, which is central to new media art practice, threaten to replace traditional creative media. WJT Mitchell articulates this fear in his article, "Showing seeing: a critique of visual culture" (2001). He perceives the growing importance of digital culture, technology and digital media within academia as partly attributing to the rise of "disciplinary anxieties" within traditional disciplines, which he claims is sometimes articulated in terms of a "territorial grumpiness" (Mitchell 2001: 166). Contrary to this perception, using the digital platform as a creative tool or medium neither dilutes nor serves to replace traditional media. Rather, the mediation of the digital platform can invigorate traditional media and broaden the ways in which they are conventionally conceived, processed and accessed. This is exemplified by the resurgence of experimental animation practice and its emerging status as a dynamic hybrid form within contemporary and new media art platforms.

Figure 6. Hoogebrugge, H. 2003, Installation: La Grande Fête des Voyeurs [Online] Available: https://www.artslant.com/ew/works/show/687895 (Accessed 3.01.2018)

To conclude, from its relative obscurity during the analogue era, in the digital age experimental animation has come to represent a hybrid form of moving image practice with infinite creative possibilities that are well-suited to new media art practice. Weibel talks about how with "the practices of the new technological media we can also embark on a fresh evaluation of the practices of the old non-technological media" (2006). In this regard, one can hold up the new media practice of experimental animation against the old technological medium of experimental animation as a prime example.

References

Kinsman, J. 2013.A nose by any other name. *Portrait Magazine*, October [Electronic], Available: http://www.portrait.gov.au/magazines/46/a-nose-byany-other-name (Accessed 3.07.2016).

Leslie, E. 2002.*Hollywood flatlands: Animation, critical theory and the avant-garde*. New York: Verso.

Manovich, L. 2002. Avant-garde as software. [Electronic] Available: https://www.uoc.edu/artnodes/espai/eng/art/manovich1 002/manovich1002.pdf (Accessed 01.05.2015).

Manovich, L. 2001. *The language of new media*. Cambridge, Massachusetts: MIT Press.

Mitchell, W.J.T. 2001. Showing seeing: a critique of visual culture. *Journal of Visual Culture*, 1(2): 165–181, [Electronic] Available: http://faculty.georgetown.edu/irvinem/theory/Mitchell-ShowingSeeing.pdf (Accessed 27.05.2014).

Moritz, W. 1997.Restoring the aesthetics of early abstract films. In: J. Pilling (ed.), *A reader in animation studies*. UK: John Libbey & Company, pp. 38–49.

Paul, C. 2002. Renderings of digital art. *Leonardo*, 35(5): 471–484, [Electronic], Available: http://www.jstor.org/stable/1577254?origin=JSTORpdf (Accessed 20. 07. 2016).

Pilling, J. 2001. *Animation: 2D and beyond*. Switzerland: RotoVision SA.

Pressman, J. 2014.*Digital modernism: Making it new in New Media*. New York: Oxford University Press.

Roberts, E. 1998.Hand-crafted cinema animation workshop with Caroline Leaf. *National Film Board of Canada*, [Electronic] Available: http://www.nfb.ca/film/handcrafted_cinema/?utm_campaign=programming&utm_source=facebook&utm_medium=socialmedia&utm_content=film (Accessed 19.06.2016).

Rothberg, M. 2013. Multidirectional memory and the implicated subject: On Sebald and Kentridge. In: L. Plate & A. Smelik (eds), *Performing memory in art and popular culture*. New York: Routledge, pp. 39–58.

Schönfeld, C. 2006. Lotte Reiniger and the art of animation. In: C. Schönfeld (ed.), *Practicing modernity: Female creativity in the Weimar Republic*. Würzburg: Königshausen & Neumann.

Seago, A. & Dunne, A. 1999. New methodologies in art and design research: The object as discourse. *Design Issues*, 15(2), Summer, [Electronic] Available: https://www.jstor.org/stable/1511838?seq=1#page_scan_tab_contents (Accessed 4.05.2016).

Shankon, E *Contemporary Art and New Media: Digital Divide or Hybrid Discourse?* In: Paul, C (ed), 2016, *Companion to Digital Art, First Edition*, John Wiley & Sons, Inc.

Simon, M. 2003. *Producing independent 2D character animation*. London: Focal Press.

Weibel, P. 2006. The post-media condition. *AAVV Exhibition: The Postmedia Condition*. Madrid: Centro Cultural Conde Duque. [Electronic] Available: http://www.metamute.org/editorial/lab/post-mediacondition (Accessed 01.06.2016).

Wells, P. & Hardstaff, J. 2008.*Re-imagining animation: The changing face of the moving image*. London: Fairchild Books.

Wells, P. 2002. *Understanding animation*. London & New York: Routledge.

Williams, D. 1990.*Creative Process: Norman McLaren*. [DVD]. Montreal: National Film Board of Canada.

Smile to Vote: Towards Political Physiognomy Analytics - Predicting Electoral Behavior from Live Video

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Keywords

Facial Recognition, Psychometrics, Computer Vision, Artificial Intelligence, Government 4.0, Privacy 4.0, Media Art, Interactive Installation

Abstract

This Paper proposes a novel application of psychometric computer vision analysis. It describes the experimental use case of an interactive voting booth, which is able to retrieve, in real-time, the political conviction of any given person from their facial physiognomy by means of computer vision. After an overview of relevant developments in the fields of psychometrics, computer vision as well as AI-driven political data science, the article describes the design and the operating principle of the interactive voting booth.

1. Introduction

Against the backdrop of currently trending AI-driven political campaigns and the related 2018 Cambridge Analytica data scandal, *Smile to Vote* escalates the latest research findings in the field of psychometrics and merges them with the worry-free big scale implementation of facial recognition systems in life style products and daily business processes. The conceptual media art piece portrays the fictitious Govtech startup *Smile to Vote* and its cutting edge product with the same name: an ultra efficient e-voting booth.

By means of AI-based facial scanning, the e-voting booth gages the political conviction of any given person and emulates the process of digitally casting a vote at a federal election by simply looking into a camera.

The work addresses the religiously recited aspirations of global IT companies of turning the world into a better place by way of their products, as well as their apparent believe in a superhuman objectivity of algorithmical decision making. Also, it aims at highlighting an apparent discrepancy between these aforementioned aspirations and a surprising lack of respect for personal data and privacy.

Furthermore, the work addresses the question of how the large-scale deployment of AI algorithms and facial recognition applications will affect democratic decision-making processes as well as our individual understanding of privacy, freedom and self-determination.

2. Background

Starting point for the reflections was, on one hand, the perceivable effect of AI-based data analytics on the research fields of psychometrics and computer vision within the last 2 years, and the effect the both research fields are having on one another. The incorporation of deep learning (deep neural networks) into the practice of psychometrics seems to have the most profound potential as an instrument for near-complete surveillance, political manipulation and for predicting human behavior.

Taking into account the outright deceitful behavior of global IT-companies towards their users, which become somewhat apparent in Facebook's 2018 Cambridge Analytica data-scandal, this work is, on the other hand, inspired by the general public's surprising unimpressedness regarding large scale deployments of facial recognition systems.

I am going to give a quick overview over recent developments in digital psychometrics (2.1), political data analytics (2.2), the market acceptance of large-scale facial recognition implementation (2.3), and the clad und unresolved privacy fraud currently being orchestrated by global IT-companies (2.4).

2.1 Digital Psychometrics

Deep neural networks are capable of detecting minute statistical anomalies in data sets, below the threshold of human perception. Therefore machine-learning algorithms are able to interpret information in ways we as humans can't retrace.

Kosinski et al described already in 2013 the minute identification of political convictions by psychometrically analyzing social media data-footprints. They showed to be able to determine personality traits by analyzing not more than Facebook "Likes". Political conviction could be correctly determined with 85% accuracy. [Kosinski et al, 2013]

In 2017 several papers described methods to determine personality traits by means of automated psychometric computer vision analysis of social media profile photos:

Cristina Segalin et al concentrated on the automated evaluation of photos with regard to the personal traits Extraversion and Neuroticism. They also compared the accuracy of the machine's assessments with those of humans. They summarized: "The results show that computer-based classifications are significantly more accurate than averaged human-based classications for these two traits." [Segalin et al, 2017]

Yilun Wang and Michal Kosinski not only showed that "faces contain much more information about sexual orientation than can be perceived and interpreted by the human brain", but also, that computer vision systems based on deep neural networks are capable of predicting the sexual orientation of a person with higher accuracy than humans. [Wang, Kosinski, 2017]

2.2 Political Data Analytics & Micro Targeting

Personal profiles extracted from social-media footprints are used by political parties and other interest groups to optimize their odds at winning elections. Even in modern democracies, in which the protection of the citizens' freedom and privacy supposedly are reason of state, the use of micro targeting by political parties can be observed. In psychographic-based micro targeting, different data sets are combined to derive high resolution profiles of political conviction. Depending on legal situation and quality of the used data sets, the resulting profiling can be accurate down to the individual voter. The two most prevalent use cases of micro targeting in political campaigns are:

A) Personalized digital campaign advertisement
Matching their calculated personal profiles, individual users can be targeted with personalized campaign advertisements on the internet. Brian Swhichkow has shown that the needed tools for individually targeting internet users is readily available for everybody at very low cost and convenient ease of use. [Swhichkow, 2014]

The potency and granularity of such tools can, for example, be gaged by the targeting options listed on the Facebook Advertiser Help Center. (see Table 1)

- What people share on their timelines
- Apps they use
- Ads they click
- Pages they engage with
- Activities people engage in on and off Facebook related to things like their device usage, purchase behaviors or intents and travel preferences
- Demographics like age, gender and location
- The mobile device they use and the speed of their network connection

Table 1: Detailed targeting options in the Facebook Advertiser Help Center [1]

In the wake of Facebook's 2018 Cambridge Analytica data scandal, an Email from May 2014 surfaced, sent by Dr Aleksandr Kogan [2] to Christopher Wylie [3]. In it Dr. Kogan described an ever more granular "shopping list" of predictable personality traits available for targeting. (see Table 2)

- openness
- consciousness
- extraversion
- agreeableness
- neuroticism
- life satisfaction
- iq
- political views = conservative?
- political views = liberal?
- political views = uninvolved?
- political views = libertarian?
- religion (categorical)

Table 2: Selection of more granular targeting options, offered to Cambridge Analytica by Dr. Aleksandr Kogan in May 2014 [4]

It is interesting to note, that none of the six major political parties currently elected in the German German federal parliament (Bundestag) have publicly declared to waive the use of digital campaign advertisements based on micro targeting. [Linder, 2017]

B) Optimization of door to door campaigning
Electorate profile data can be projected onto maps to optimize door to door campaigning. Route optimization can be based on profitability calculation, predicting expectable conversion rates of undecided voters in a specific area.

As an example the company Cambridge Analytica "from July 2016 on […] provided election workers of the Trump campaign with an App, with which they could identify the political conviction as well as the personality type of residents of a specific house." "The election workers also had conversation guidelines matching the personality type of the resident." (Author translation) [Grassegger, Krogerus, 2016]

During the federal election campaign 2017 in Germany, the Christian Democratic Union of Germany (CDU) deployed an app called "Connect17". The CDU party head quarters went on record with the statement: "Via the Deutsche Post Direkt GmbH we have bought a potential analysis [data set] on the level of street accuracy. That means, that the statistical probability, with which the CDU will be voted for, has been calculated for a residential block." (Author translation) [Keller, 2017]

Because of a data breach on the Website of the Free Democratic Party (FDP), the precision of the party's micro targeted campaigning during the German federal election campaign 2017 was revealed. Simon Hegelich, of the Technical University Munich, analyzed the erroneously exposed electioneering tool and noted: "On a map one can zoom in so far (in the big cities), that one gets displayed the likelihood of 60% or 80% whether the inhabitants of individual houses are FDP-voters." (Author translation) [Hegelich, 2017]

2.3 Market Acceptance of Facial Recognition

Facial recognition technology is currently being deployed extensively for the mass market. The potent feature is conveniently implemented in practical use cases, which facilitate mundane daily tasks.

Fig 1. Video still from Apple's iPhone X Commercial, visualizing functionality of Face ID, September 2017 [5]

In September 2017, the IT company Apple implemented a technology, called Face ID, in their latest smartphone iPhone X. Face ID creates high resolution physiognomical data sets of their users' faces by means of a camera and depth sensors. Physiognomical analysis hereby becomes a hip lifestyle product. [6]

Similar to one of Apple's proposed use cases, in which users can identify themselves for business transactions using Face ID on their iPhone X, it is now possible in China to pay in fast food restaurants with just a gaze into a camera. Also in September 2017, Alibaba's facial recognition system "Smile to Pay" saw a large-scale roll out as an identification method for payment processes. [7]

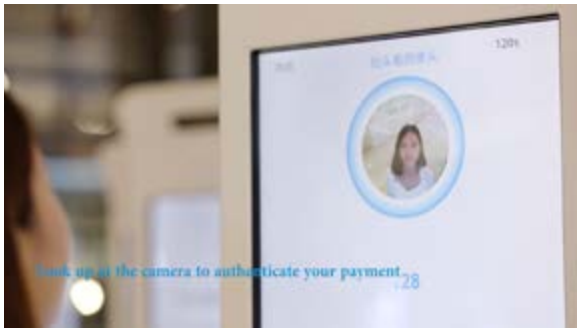

Fig 2. Video still from Alibaba's Smile to Pay Commercial, "Look up at the camera to authenticate your payment", September 2017 [8]

Surprisingly, there is currently no indication of client refusal to use these products and services due to privacy concerns.

2.4 Large-Scale Privacy Fraud and Unprosecuted Mass Surveillance

Despite claiming the opposite, the surveillance and data-collection practices of IT-companies, whose business models are based on micro-targeted advertisement, present an enormous breach of privacy laws in both Germany and Europe. This becomes evident in the light of recent revelations during Facebook's 2018 Cambridge Analytica data scandal. Neither are users asked for their consent to be surveilled, spied upon and psychometrically analyzed, nor are the users given the possibility to gain a comprehensive overview of all the data that have been associated with them.

In his testimony before the U.S. Congress, Mark Zuckerberg claimed, that "The information that we collect, you can choose to have us not collect. You can delete any of it" [9].

In contrast to this statement stands Facebook's proven practice to collect as much data as possible on any internet user - no matter if he or she has a Facebook account - and aggregate these data in so called "shadow profiles". Facebook's Methods to harvest these shadow data include, amongst others:

A) Third-party tracking by means of "Like"-buttons and other browser fingerprinting techniques [Englehardt, Narayanan, 2016].

B) Cross-referencing electronic address books of anybody who uploads her/ his address book to any of face book's services (see the 6 million user data breach in 2013 [10]).

C) Scraping meta data from users' activity unassociated with Facebook services, like calling and texting on android phones [Gallagher, 2018].

A complete summary of all data that Facebook has associated with a user - including aggregated and derived meta data - is not offered by the company. This leaves no way to monitor a termination of data collection or the deletion of user-associated data, contrary to what Mr. Zuckerberg has suggested. The fact that it is not possible to access one's so called "shadow profile", poses a massive constraint of basic civil rights. Title 2, article 8 of the Charter of Fundamental Rights of the European Union, entitled "Protection of personal data", states: *"(1) Everyone has the right to the protection of personal data concerning him or her. (2) Such data must be processed fairly for specified purposes and on the basis of the consent of the person concerned or some other legitimate basis laid down by law.* ***Everyone has the the right of access to data which has been collected concerning him or her, and the right to have it rectified."*** [11]

It remains yet to be seen as to when and how Europe's executive and judicial powers will respond to this continually abolishing of privacy.

3. Smile to Vote

Under the impression of above mentioned observations, the installation *Smile to Vote* pursues two thematic leitmotivs, which solidify in an interactive experience.

Firstly, the consequent application of computer-vision analysis on political conviction.

Secondly, the application of the "Smile to pay" - principle on the process of casting a vote at an election.

3.1 Installation Setup

The installation is comprised of a voting booth equipped with camera, screen, computer and printer (see Fig 3). The computer is running the *Smile to Vote* - software.

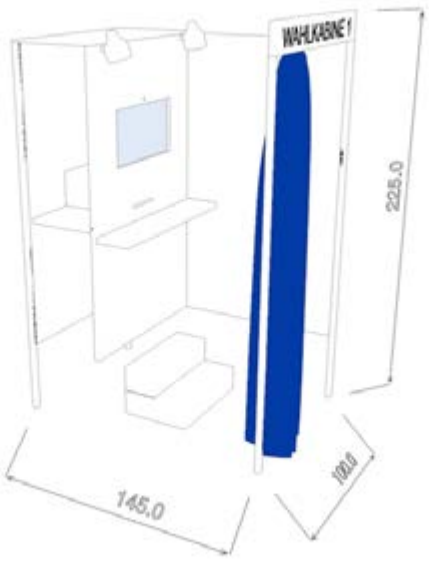

Fig 3. CG-visualization of the *Smile to Vote* voting booth, 2017, ©Alexander Peterhaensel

3.2 The Smile to Vote - Software

Building on the basis of Wang and Kosinski [Wang, Kosinski, 2017], the *Smile to Vote* - software employs AI-based computer vision analysis to gage the facial characteristics of a person and compare them to photo datasets, which have been classified by political conviction. By using a deep neural network, that has been trained on photos of people who's party membership and political affiliation are unequivocal, it becomes possible to deduce, in real time, the political conviction from the face of any given person, that is captured by the camera. (see Fig 4)

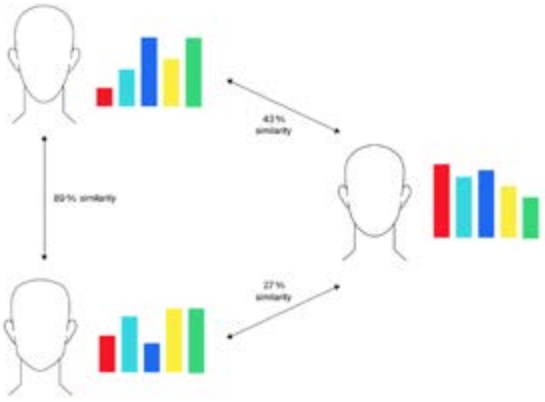

Fig 4. Similarity comparison of facial physiognomy profiles in the *Smile to Vote* - software, 2017, ©Alexander Peterhaensel

The software is programmed in Unity and uses functionalities of OpenCV [12] for face detection and face recognition.

First, the pre-trained OpenCV algorithm searches for faces in the live video feed. A soon as a face is detected, the cropped area of the video image gets compared with the trained data set of party members and election candidates. The physiognomical congruency between the voter and eligible parties is derived in percent and displayed as a bar chart on the screen.

The software is built on an open and flexible architecture in order to permit for the representation of all kinds of different electoral processes. This paper describes the localized use case for the german electoral system, which features two votes per voter [13].

For possible upcoming German federal elections, the neural network for physiognomical recognition is currently trained with two data sets:

Data set A contains all top candidates of all parties and is relevant for the calculation of the primary vote.

Data set B contains all candidates of all parliamentarians currently elected in the German Bundestag. This data set is relevant for the calculation of the secondary vote. All photos of the members of the German Bundestag are retrievable from the Bundestag website. [14]

The used approach is still experimental to that end that, due to data protection and privacy regulations, the used deep neural networks can currently only be trained with a relatively small data set. A large scale photo database with meta data of political conviction does not exist in Europe (so far). The herein proposed method could potentially be used for creating such a database. Expectable future advancements in the efficiency of deep neural networks and an enhancement regarding the possible use of small data sets, would foster the presented use case and would allow for an even more robust performance.

3.3 Process of Vote-Casting

Step 1: Triangulation. As soon as a person steps in front of the screen, the system awakens. The person's face is tracked by *Smile to Vote*'s computer vision and triangulated. The person is asked to look into the camera to cast her or his vote.

Step 2: Physiognomy scanning. The person's face is scanned and physiognomically measured. (see Fig 5)

Step 3: Psychometric analysis. The system then analyses the characteristic facial feature data set and calculates the person's political conviction. In order to achieve this, a deep-learning algorithm compares the person's facial physiognomy with characteristic

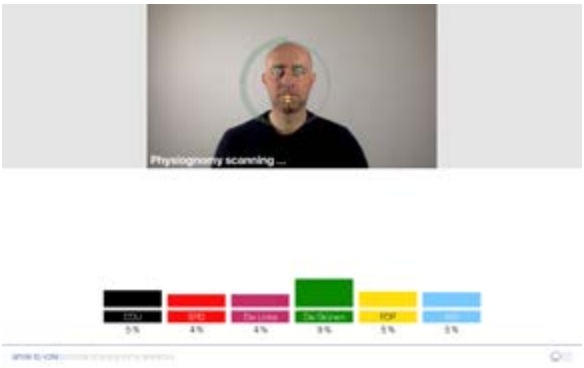

Fig 5. Screen shot of the *Smile to Vote* - software, Physiognomy scanning, 2017, ©Alexander Peterhaensel

physiognomy traits of all political parties eligible for election. The system, thus, is capable to derive the person's concordance with political parties in percent. To facilitate the German electoral process, the primary and secondary vote are derived form the voter's face in a two pass analysis; using data set A for the first pass and and data set B for the second pass.

Step 4: Vote registration. The installation emulates the immediate registrations of the person's vote in the central registry of an electoral commission. The voter is informed on the screen about the successful cast of her/his vote and receives a printed receipt. (see Fig 6)

The whole process takes about one minute.

Fig 6. Screen shot of the *Smile to Vote* - software, Registration of vote, 2017, ©Alexander Peterhaensel

3.4 Localized Versions of the Software

The software can be localized for different countries and electoral systems. All that is needed, are the photos of the electoral candidates.

Currently the *Smile to Vote* - software exists in 3 versions:

- 2019 European Parliament Elections
- 2018 German Federal Elections
- 2018 German Bavarian State Elections

Conclusion

This paper proposed a novel use case of psychometric computer-vision analysis on the basis of deep neural networks for the automated real-time retrieval of political convictions from facial physiognomy. It gave a brief overview over relevant developments in the fields of psychometrics, computer vision as well as AI-driven political data science. Furthermore, the article described the setup as well as the functionality of an experimental prototype, which deploys the proposed methodology as an interactive e-voting booth. The essential novelty of the described installation is the real-time realization of psychometric analysis of a live-video feed.

Especially the real-time capability of the herein proposed method contains enormous hazard potential for privacy, since it could be easily and seamlessly implemented in already existing surveillance infrastructures. Conceivable is a dystopian use case of permanent real-time gaging of political convictions of huge masses of people - if not entire populations.

Interaction with the *Smile to Vote* - voting booth translates the complex ramifications of delegating decision making to IT systems into an aesthetic experience and therefore makes these ramifications immediately tangible and intuitively comprehensible for the recipient. The work confronts us with the implications for political processes as well as for our understanding of self-determination and freedom of will, once predictability of our very behavior through IT systems becomes ubiquitous.

The presented use case is merely a first step in a novel field of research. Many new research questions have already arisen. Next steps of my work will deal with the optimization of data models for the machine learning modules as well as an improvement of the computer vision's accuracy. Apart from producing more localizations of the installation, also the evaluation of user feedback from different cultural backgrounds appears to be of high interest.

Acknowledgements

I would like express my gratitude to Prof. Anna Anders, Julian Netzer and Christopher Höhn for their generous input and feedback. Also, I would like to thank the anonymous reviewers of this paper.

References

[1] https://www.facebook.com/business/help/182371508761821?helpref=faq_content, Retrieved Jan 20, 2018

[2] Lecturer at the the Department of Psychology at the University of Cambridge, who harvested data from Facebook users and sold these to Cambridge Analytica [4]

[3] Former employee at Cambridge Analytica, who played a vital role in revealing Facebook's improper sharing of user data with Cambridge Analytica [4]

[4] https://www.nytimes.com/2018/03/17/us/politics/cambridge-analytica-trump-campaign.html, Retrieved March 21, 2018

[5] https://www.youtube.com/watch?v=K4wEI5zhHB0, Retrieved Jan 20, 2018

[6] https://www.apple.com/newsroom/2017/09/the-future-is-here-iphone-x/, Retrieved Jan 20, 2018

[7] https://www.cnbc.com/2017/09/04/alibaba-launches-smile-to-pay-facial-recognition-system-at-kfc-china.html, Retrieved April 15, 2018

[8] https://www.youtube.com/watch?v=f-NIAUhU2E0, Retrieved Jan 20, 2018

[9] https://www.washingtonpost.com/news/the-switch/wp/2018/04/11/transcript-of-zuckerbergs-appearance-before-house-committee/, Retrieved April 15, 2018

[10] https://www.facebook.com/notes/facebook-security/important-message-from-facebooks-white-hat-program/10151437074840766?_fb_noscript=1, Retrieved April 15, 2018

[11] http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:12012P/TXT&from=EN, Retrieved April 15, 2018

[12] opencv.org

[13] https://en.wikipedia.org/wiki/Electoral_system_of_Germany, Retrieved April 15, 2018

[14] https://www.bundestag.de/abgeordnete, Retrieved Jan 20, 2018

Bibliography

Englehardt, S & Narayanan, A (2016). *Online Tracking: A 1-million-site Measurement and Analysis*. Proceedings of the 2016 ACM SIGSAC Conference on Computer and Communications Security. 10.1145/2976749.2978313

Gallagher, S. (2018). *Facebook scraped call, text message data for years from Android phones*, Retrieved April 12, 2018 from https://arstechnica.com/information-technology/2018/03/facebook-scraped-call-text-message-data-for-years-from-android-phones/

Grassegger, H. & Krogerus, M. (2016). *Ich habe nur gezeigt, dass es die Bombe gibt.* Das Magazin N°48, Retrieved Jan 20, 2018 from https://www.dasmagazin.ch/2016/12/03/ich-habe-nur-gezeigt-dass-es-die-bombe-gibt/

Hegelich, S. (2017). *#FDPleaks: Hype und Hybris im Datenwahlkampf*. Retrieved Jan 20, 2018 from https://politicaldatascience.blogspot.de/2017/08/fdpleaks-hype-und-hybris-im.html

Keller, G. (2017). *Microtargeting im Bundestagswahlkampf: Nah am Wähler und anfällig für Manipulation*. Berliner Zeitung, 09.08.2017, Retrieved Jan 20, 2018 from https://www.berliner-zeitung.de/politik/bundestagswahl/microtargeting-im-bundestagswahlkampf-nah-am-waehler-und-anfaellig-fuer-manipulation-28137412

Kosinski, M. & Stillwell, D. & Graepel, T. (2013). *Private traits and attributes are predictable from digital records of human behavior*. Proceedings of the National Academy of Sciences of the United States of America. 110. . 10.1073/pnas.1218772110.

Lindner, N. (2017). *Digitale Kampagnenführung. Die Parteien und das Netz*. Deutschlandfunk 10.09.2017, Retrieved Jan 20, 2018 from http://www.deutschlandfunk.de/digitale-kampagnenfuehrung-die-parteien-und-das-netz.724.de.html?dram:article_id=395541

Segalin, C. & Celli, F. & Polonio, L. & Kosinski, M. & Stillwell, D. & Sebe, N. & Cristani, M. & Lepri, B. (2017). *What your Facebook Profile Picture Reveals about your Personality*. . 10.1145/3123266.3123331.

Swichkow, B. (2014). *The Ultimate Retaliation: Pranking My Roommate With Targeted Facebook Ads*. Retrieved Jan 20, 2018 from http://ghostinfluence.com/the-ultimate-retaliation-pranking-my-roommate-with-targeted-facebook-ads

Wang, Y., & Kosinski, M. (2017, Oct 16). *Deep neural networks are more accurate than humans at detecting sexual orientation from facial images*. Retrieved Jan 20, 2018 from http://osf.io/zn79k, (in press) Journal of Personality and Social Psychology

Author Biography

Alexander Peterhaensel is an interdisciplinary audiovisual media artist, composer, performer and researcher. His work focusses on Computer-mediated Realities, Immersive Architectures, Visual Music as well as Systems Engineering as an artistic field. He has performed, exhibited and lectured at various international festivals and conferences and has released several records, amongst others at Ars Electronica, CCCB Barcelona, Centrum Beeldende Kunst Dordrecht, c/o POP, Fundacion Ludwig de Cuba, Institut Français d'Agadir, Museum für Angewandte Kunst Köln, Museo de Arte Moderno de Medellín, re:publica and at Transmediale Berlin.

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Generating Diversity: Art, robots, and the future of farming

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Keywords

generative art, agroecology, robotics, diversity, hybrids

Abstract

The dominant systems of agriculture that provide food for much of the world suffer from a lack of crop diversity, which leaves them vulnerable to the spread of disease and pests. This paper proposes that this is, in part due to the machinery used in industrial agriculture. It introduces a project, *Evolving Species One*, that is grounded in artistic practice and robotics research that draws inspiration from gallery-based robotic artwork to try to design and evolve robots that can cultivate diversity in the plants that are growing within a complex farm ecosystem.

Introduction

Farmed food sustains the majority of human life on this planet. The contemporary global system of agricultural production and trade is both a result and a driver of a complex network of ecological, political, economic, and social factors. It is also highly fragile. Its fragility has many sources [1–3], one of which is a consequence of humanity's dependence on relatively few foods for a large portion of day-to-day nourishment and the reliance on a small number of distinct varieties of those foods in agriculture [4]. It is estimated that 12 plant species account for about 80% of plant-based food that humans eat[1] [3].

The Irish potato famine of 1845-1849 serves as a ghastly reminder of what can happen when a society relies on monocultures for the majority of its nutrition. The confluence of heavy reliance on a single staple crop and the rapid spread of a pathogen through that crop caused almost inconceivable human tragedy. In light of this, there are a number of scientific efforts to mitigate the problems caused by a lack of crop diversity. Researchers have accelerated efforts to store copies of a wide range of crops in disaster-resistant seed banks to serve as genetic repositories [5–8]. Others are actively creating new varieties of key crops — through genetic engineering and conventional breeding techniques [1, 9, 10]. These are attempts to create crops that are resistant to the pests and pestilence that are most likely to threaten them in the near future [1, 10] or that can grow in the shifted ecosystems that climate change will create [1, 9].

These efforts represent important contributions to the conservation of crop diversity and food security in the current agricultural system, but they are insufficient on their own. Seed banks are useful repositories, but they contain static snapshots of a plants' genetic composition at a particular point in time rather than living, evolving specimens [6]. Those seeds are also stripped of their ecological contexts: climates, soils, symbionts, predators, diseases, and the cultural knowledge that is often required to successfully cultivate them [5, 6]. The engineering and plant breeding that takes place at research labs is important for helping agricultural systems cope with emerging challenges, but by necessity — due to the intensity and scale of the effort required to create new breeds — they are wedded to a form of agriculture that focuses on "crops that could be grown across millions of acres, regardless of where someone might plant them" [3].

This paper suggests an alternate and complimentary approach to generating and maintaining crop diversity, that arises from a series of explorations of generativity and complexity in robotic art and agroecology[2]. It begins with a discussion of several works of art that explore themes of emergence, hybridity, and the generation of diversity through the use of robots and artificial intelligence systems.

The behaviours and systems found in those works give rise to one of the premises of the ongoing artistic project explored in this paper: the ongoing exploration of robots in agroecological systems called *Evolving Species One*. *Evolving Species One* envisions a future agriculture in which many varieties of food are grown together in a complex web that emulates a grassland or forest[3] that also hosts biological and robotic "animals" that live in and among the plants. The robotic animals monitor the growth of the plants and the health of the ecosystem, they harvest edible parts of plants, and distribute waste and seed as would biological animals. *Evolving Species One* represents an attempt to evolve[4] the

[1] Measured by caloric intake.

[2] A system of producing food that relies on principles of ecology and ecosystem management to cultivate a complex landscape that produces food with minimal use of external inputs [4]

[3] Depending on the ecosystem that typically exists in the region. This type of agriculture is known as agroecology and encompasses of a number of novel [11] and well-established [12] practices as well as many traditional agricultural systems [6].

[4] Using techniques from evolutionary computing and robotics [13].

first robotic species that will inhabit such an ecosystem.

Seeds, Diversity, and Fragility

Crops are traditionally propagated in one of two ways [14]: sexually, via the collection and dispersal of seeds, and asexually by techniques like grafting and the replanting of harvested roots and bulbs. Sexual reproduction in plants is a key driver of hybridisation and diversification as it allows the plant to incorporate genetic material from neighbouring plants and varieties and leads to seeds that are genetically distinct from the parent plant [14]. Cereals are reproduced this way and researchers have used this to trace the genetic origins of wheat [15] and to understand how forces of natural and human selection have combined to form the basic types of wheat found in grocery stores today. However, these same cereals also have a trick to maintain a variety that is well-adapted: they self-fertilize. Most wheat flowers are fertilized by their own pollen, producing a genetically identical offspring.

Potatoes, on the other hand, are almost always planted from seed potatoes from a past harvest. The term "seed potato" is somewhat misleading in that they are in no way seeds, but rather a genetically identical part of the parent plant. This confers some benefits such as the knowledge that the potatoes grown from the "seed" potato will be the same as the potatoes grown the year before[5] as well as the other potatoes planted from the same stock. They will all taste similar, require the same nutrient amendments, and be ready for harvest at the same time.

The same feature that makes it easy to sell a field full of a particular variety of potato (or wheat) to the supermarket makes those potatoes vulnerable. In Ireland in the mid-19th century, the potato was a key staple food for much of the island's population [16]. Nearly all of the potatoes grown in Ireland were of a single variety, the Irish Lumper, a species which was susceptible to late blight[6] [3, 17]. Weather conditions in Ireland between 1845 and 1849 were ideal for the growth of late blight [3] and the lack of diversity of potatoes contributed to the blight's rapid spread[7] [17]. By the early 1950s, Ireland had lost 20% of its population to famine and migration [19].

Ecologist Rob Dunn [3] explains in a broader fashion why outbreaks like this occur: Many foods are grown far from the ares in which they evolved. This often allows them to escape some of the pathogens and predators they would have encountered in their native territories — those which evolved to prey on them. As they are bred to be more productive, tastier, and easier to harvest, they lose some of the defences that they have developed to combat particular enemies. In escaping their adversaries, they have also left behind close relatives that might retain resistance to a range of adversaries and symbionts that help the plant deal with diseases and infestations. When the foe eventually catches up to the displaced and now-defenceless plant, it spreads like wildfire and decimates entire regions in the span of years or even months. This pattern has repeated with coffee in Sri Lanka [20], cocoa in Brazil [21], and potatoes in Ireland [19], to name a few. Some ecologists are convinced that it is only a matter of time before another staple crop succumbs to disease or pest [3, 11].

Plant scientists take a number of approaches to address this problem. Plant genetic material is banked in storage facilities spread around the world so that a library of genes exists for use in combating future problems. Plant breeders can cross banked varieties with common varieties to produce seeds that combat specific threats. Broadening the horizon, plant geneticists can insert genes across variety and species lines to create insecticide-producing plants, and target pathogens and predators even more precisely.

These efforts are met with varying degrees of technical efficacy and public acceptance, but what unites them all is the assumption that, in the end, most farmers in a large area will grow a single, genetically pure variety of a crop for which they purchase material (seeds, bulbs, or "seed" tubers) from a single source. They fail to consider the possibility of renewing the practice of generating diversity — and through it resilience — in the field [6][8].

Robots, Art and Diversity

Why has much of the existing agricultural research focused on banking genetic diversity and generating new varieties in labs as opposed to in the field? This paper proposes that one of the main reasons this possibility has been discounted is that agricultural practitioners have the wrong machines for such work. Agricultural equipment — like most heavy machinery — is engineered for mechanical efficiency. The motions required to plow, sow, fertilize, and harvest a field of a single type of wheat grown in rows[9] are mechanically efficient. The complex tasks of finding and separating many varieties of wheat growing among other grains in a mixed grassy ecosystem are not. As a result, agricultural machines enforce monotony and regularity and farmers and researchers have adapted seeds and practices to suit.

But artists have long experimented with machines that generate novelty, creativity, and the unexpected. Even if these works are not explicitly about agriculture, the underlying systems they explore can be relevant in the study of how robots might be deployed to generate and maintain agricultural diversity. Works like Gordon Pask's *The Colloquy of Mobiles* (1968), Edward Ihnatowicz's *The Senster* (1970), Harold Cohen's *AARON* (1973), Daniel Jolliffe's *Untitled Ball* (1993), Camille Utterback's *Untitled 5* (2004), Ruairi Glynn's *Performative Ecologies* (2008), Philip Beesley's *Hylozoic Ground* (2010), and my earlier work, *Subtle Emergences* (2015), use combinations of computational intelligence and robotics to create complex systems that explore the relationships between communities of machines and the humans in their en-

[5] In a genetic sense. This discounts somewhat the effect of the growing environment on the resulting potato.

[6] *Phytophthora infestans*.

[7] There was also a political-economic element to the famine. Agriculture is never just biological. [18]

[8] There are in fact many local efforts to maintain a diversity of crops on farmers' fields, a practice known as *ex-situ* conservation of diversity [22]. These efforts, however, are largely excluded from agricultural practices in which robotics and automation are employed.

[9] And even this is immensely complicated.

(a) An installation detail from *Subtle Emergences*. Shows one of the hanging robots and the projection of its shadow.

(b) *Sentient Veil*, a 2017 installation by Philip Beesley, following the work on *Hylozoic Ground* in 2010. © PBAI/LAS 2017

Figure 1: Robotic installations have a long history of experimenting with themes of hybridity and generative environments.

vironments.

The work of Pask and Ihnatowicz is rooted in the cybernetic principles of feedback [31] and the ever-changing nature of the work arises from the complexity of the interactions and feedback loops built into the system. Pask's hanging elements respond to and produce audiovisual stimuli creating auto-feedback loops as well as being open to external stimulation. *The Senster* operates in much the same way, its movements following sound in the space, though its form recalls a far more animal-like type of robot. *Untitled Ball* is less explicit about how it senses but the viewer is aware that it *is* sensing. While it is still a feedback-driven art machine, it differs from its predecessors in that it locomotes. Where Pask and Ihnatowicz's works move in relation to a fixed mount point, Jolliffe's sculpture is free to traverse the room with gallery attendees, which creates a new level of danger and intrigue for the viewer. The generated novelty in these works does not manifest in the form of new objects; it arises from new configurations of actors in the space, new relationships that are constantly formed, broken and reformed. The novelty is systemic.

A set of different approaches are taken in Cohen's *AARON* and Utterback's *Untitled 5*. Their works are primarily visual in nature and *AARON* has no mechanism for live feedback, though Utterback's incorporates feedback as the motion of visitors directs the drawing process. *AARON*'s images are shown as static works, the final results of a computational process, while *Untitled 5* is rendered as a dynamic, shifting project. Cohen was often careful to not attribute independent creativity specifically to *AARON*, preferring to think about *AARON*'s work in terms of degrees of autonomy [32]. Sidestepping the contentious debate about what constitutes creativity, it is clear that the images that are generated by both *AARON* and *Untitled 5* have degrees of uniqueness and can be seen as art machines producing novel forms.

Beesley's *Hylozoic Ground* (2010) brings together these elements of novelty into a single work. The work is at once performative and constructive: its various moving, breathing, and flickering elements incorporating sensory information from the sculpture and the human visitors while its protocell structures build material from chemical reactions with hydraulic flows [29]. Later iterations incorporate explicitly explorative machine learning algorithms to motion that changes over time as well as in response to feedback [33]. The sculptures are explicitly ecosystemic with static and dynamic sculptural components grouped into species and organized into niches throughout the exhibition space.

Subtle Emergences is an interactive installation in which spotlights, hanging fabric robots, and sonic copper sculptures imbue a dimly lit gallery with subtle motion and sound [30]. The space is almost cave-like and forms a space for meditation on the concepts of emergence and complexity in the context of a robotic ecosystem. The actions and reactions of the sculptural elements in *Subtle Emergences* hover between a state of order and randomness. They are not regular, but they are directed. They are not random, but they are difficult to predict. A visitor's movements do not absolutely control the lights and motion, but they direct it, nudge it, and shape its trajectory.

In this directed randomness, it mirrors the shaping of ecosystems and the development of species. Evolution by selection — natural or artificial — is a series of random events partially ordered by the selective pressures of the ecosystem. In all of these works, technological beings in both physical and virtual forms are being given the role of co-creators, co-generators of novelty. They are generating new patterns of behaviour within themselves and the people around them; they are generating new images and audiovisual environments; they are generating new virtual forms to be printed and brought into physical existence.

Subtle Emergences envisions a human-robot version of this type of system. The robotic sculpture elements move about and visitors traverse the installation space, each gently shaping the behaviour of the other. The movements are slow, so the shifts are viscous, their changes barely perceptible. But

on evolutionary timescales[10], they progress rapidly. In the field, shifts take place over seasons, decades, centuries and millennia.

Perhaps in those fields there is a role for this type of slower, less calculated robot. Perhaps the migration of decedents of these robots — robots that are creative, evolving, and emergent — out of the gallery and into the wild might help trigger the rediversification of some of the most monocultured spaces.

Evolving Species One

This migration is precisely the premise of the ongoing research project *Evolving Species One*. The project envisions a shift in agricultural practices from large-scale industrial agriculture to multi-scalar agroecological environments populated by biomimetic robots. These robots inhabit the agroecosystem alongside its fauna and flora and perform roles now filled by massive machines and human gardeners in the manner in which they would be performed by non-human animals. They distribute seed alongside composted waste and nutrient-rich liquids as they traverse the ecosystem. Their movements gently shape the landscape, creating and shifting habitats as a beaver shifts the rivers with a dam [34]. They monitor the environment and help to harvest tubers, seeds, berries, leafy greens, fruits, and vegetables as they ripen.

That is not to say that there are not already efforts to try to miniaturize agricultural robots. Tertill [35] is a Roomba-sized outdoor robot that kills weeds using a miniature "weed-whacker". It identifies weeds by height — if it is short, it must be a weed[11]. Another, FarmBot [36], draws inspiration from CNC milling machines and features a robotic arm that can traverse a planter bed and perform essential gardening functions like seeding, watering, and harvesting. These efforts are interesting steps away from conventional approaches to farm and garden mechanization, however, they and other related efforts tend to be limited in scope (Tertill) and still set in notions of gardens as well-ordered grids (FarmBot).

Evolving Species One draws inspiration from experiences working on *Subtle Emergences* and recent versions of Beesley's sculptural installations. These installations consist of a population of robots evolving alongside humans in a set of constantly changing environmental conditions. In the same vein, *Evolving Species One* envisions robots evolving in an ecosystem that is subject to human concerns about food and systemic concerns about maintaining a resilient growing environment. It aims to treat an agroecosystem as a complex space from which interesting new crop varieties may emerge that must be conserved and cared for in addition to caring for existing crops.

Evolving Species One is specifically concerned with the design and evolution of the first robot species to inhabit such an ecosystem. What morphology will it have and what morphological features will be evolvable? How will it locomote around an agroecosystem and how will it make sense of the surroundings it finds itself in? Hints at the answers to these questions are beginning to emerge through practice-based explorations[12] and forthcoming papers [37]. Another question unfolds in the context of this discussion on the purity, hybridity and diversity of seed lines: How might such a system generate and encourage the development of a diverse seed stock in the field?

Most of the existing diversity of crops can be found on the fields of small farms that have saved and shared seeds within a local community for generations [6]. These varieties are called *landraces* indicating that they are not formalized, static *breeds*, but they are distinctive-yet-dynamic populations of a crop that has evolved in a particular locale with all of the associated microbes, symbionts, parasites, nutrients, and farming practices. These landraces exist because, for generations, farmers have selected and planted seeds from a previous crop, often alongside its wild relatives[13] [38].

The system of industrial agriculture has divided these labours — growing crops and producing seed — such that crops no longer spend multiple generations in the same field [1]. In any case, crop diversity in an industrial farm is a threat to the efficiencies of mass mechanization. Crop breeds have usually been selected for a range of reasons including their ease of harvest, but lately, machine requirements have driven crop selection in some novel and surprising ways. On one California farm where heads of lettuce were recently harvested by workers on hand and knee, a robotic harvester now uses a water jet to slice the heads of lettuce off their bases and pulls them up to standing level for workers to process and sort [39]. In addition to changing the working environment, this has led to a need to change the variety of lettuce to one that grows in more of a bulb-shape to give the cutter more clearance to avoid cutting the valuable lettuce leaves. Diversity here would be a detriment to the mechanically efficient harvesting process that the farm has invested in.

But this attitude assumes that mechanical efficiency is the ultimate goal of farming technology. Here, the crop must be of a pure variety designed and chosen to suit the available technology. *Evolving Species One* subverts that paradigm by imagining crops and robots in co-evolutionary societies that feature a diversity of species and internal diversity within species. Interspecies diversity helps to create an ecosystem in which many niches are exploited and filled — an ecosystem that is ecologically efficient [40] in contradistinction to the mechanical efficiency of industrial farms. Intraspecies diversity ensures that both crops and robots are adaptable and resilient over the long term as there is a gene pool from which to incorporate adaptations to changing conditions over generations — whether those changes are related to climate, predation, pests, or other factors.

This diversification is likely to be a slow process, requiring many crop, robot — and possibly human — generations. The initial planting will see a wide variety of related crops planted

[10] At least evolution that takes place in the analog world.

[11] Small plants can be spared a gruesome fate by surrounding them with a small guardrail.

[12] For example at the Beyond Digital – Towards Biological research residency at the Chronus Art Centre in Shanghai, China (`http://www.chronusartcenter.org/en/bdtb/`).

[13] Crop wild relatives are the closest non-domesticated relatives to farmed crops, often found in abundance near the region where the crop was first domesticated, termed the *centre of origin* by Vavilov [38]

Figure 2: A hanging robot, considered an early prototype for *Evolving Species One* is observed in the installation for *Beyond Digital — Towards Biological* research residency at the Chronus Art Centre in Shanghai, China in December 2017.

in a single ecosystem[14] to sow the necessary intraspecies diversity. The robots will have to be at once attentive to features that make a plant desirable for humans, but also to factors that render it a valuable component of an ecosystem, and so the maintenance of diversity in the face of a lack of obvious utility.

Conclusion

Machines are often seen as tools of regularity. A laser printer can reproduce the same document over and over with little variation. Cruise control keeps a car at a predetermined speed. A lawn mower keeps grass cut to an exact height.

However, as machines have become smarter and more generalized, they are able to handle difference and diversity more effectively. 3D printers can print a wide range of physical objects. Cars have begun to take into account their surroundings and adapt their cruise control speeds to match the car in front of them. But these generalizations have not really made their way into farmers fields and agricultural systems. A thresher can still only process wheat that grows at a certain height.

Perhaps it is because these systems are so irregular, consisting of webs of relationships that are nearly infinite in their complexity. Using gallery-based artwork as inspiration, *Evolving Species One* has begun to explore that space, trying to evolve a robot to inhabit an agroecosystem. In doing so, it proposes the question: How can robots help to select and then preserve diversity in the crops that it lives among?

Acknowledgments

Thanks to Laura Beloff and Rosemary Lee for their help in editing this paper; to Stig Anton Nielsen, the initial designer of the RUBE hanging robot pictured in the paper; to the REAL Lab and ITU for supporting the research; and, to Kristin Aleklett for continuous inspiration.

[14] Alongside many unrelated species.

References

[1] M. Mazoyer and L. Roudart, *A History of World Agriculture: From the Neolithic Age to the Current Crisis*. London, UK: Earthscan, 2006.

[2] J. Aguilar, G. G. Gramig, J. R. Hendrickson, D. W. Archer, F. Forcella, and M. A. Liebig, "Crop Species Diversity Changes in the United States: 1978–2012," *Plos one*, vol. 10, no. 8, J. P. Hart, Ed., e0136580, Aug. 2015, ISSN: 1932-6203. DOI: 10.1371/journal.pone.0136580.

[3] R. R. Dunn, *Never out of season : how having the food we want when we want it threatens our food supply and our future*. New York, USA: Little, Brown and Company, Jan. 2017, p. 323, ISBN: 031626072X.

[4] M. A. Altieri and C. I. Nicholls, "Agroecology Scaling Up for Food Sovereignty and Resiliency," in *Sustainable agriculture reviews*, Springer, Dordrecht, 2012, pp. 1–29. DOI: 10.1007/978-94-007-5449-2_1.

[5] D. Soleri and S. E. Smith, "Morphological and Phenological Comparisons of Two Hopi Maize Varieties Conserved in situ and Ex Situ," *Economic botany*, vol. 49, no. 1, pp. 56–77, 1995. DOI: 10.2307/4255692.

[6] J. M. Pfeiffer, S. Dun, B. Mulawarman, and K. J. Rice, "Biocultural diversity in traditional rice-based agroecosystems: indigenous research and conservation of mavo (Oryza sativa L.) upland rice landraces of eastern Indonesia," *Environment, development and sustainability*, vol. 8, no. 4, pp. 609–625, Nov. 2006, ISSN: 1387-585X. DOI: 10.1007/s10668-006-9047-2.

[7] P. A. Pellegrini and G. E. Balatti, "Noah's arks in the XXI century. A typology of seed banks," *Biodiversity and conservation*, vol. 25, no. 13, pp. 2753–2769, Dec.

2016, ISSN: 0960-3115. DOI: 10.1007/s10531-016-1201-z.

[8] C. Fowler, M. Tefre, and J. Richardson, *Seeds on ice: Svalbard and the Global Seed Vault*. 2016, p. 160, ISBN: 9781632260574;1632260573;

[9] M. A. Jenks, P. M. Hasegawa, and S. M. Jain, Eds., *Advances in Molecular Breeding Toward Drought and Salt Tolerant Crops*. Dordrecht: Springer Netherlands, 2007, ISBN: 978-1-4020-5577-5. DOI: 10.1007/978-1-4020-5578-2.

[10] G. Vaidyanathan, "The wheat stalker: scientists are fighting damaging wheat fungi from east Africa, but breeding new crops won't help unless farmers plant them," *Nature*, vol. 474, no. 7353, p. 563, Jun. 2011.

[11] T. Gomiero, D. Pimentel, and M. G. Paoletti, "Is There a Need for a More Sustainable Agriculture?" *Critical reviews in plant sciences*, vol. 30, no. 1-2, pp. 6–23, Jan. 2011, ISSN: 0735-2689. DOI: 10.1080/07352689.2011.553515.

[12] W. B. Campbell and S. Lopez Ortiz, Eds., *Integrating Agriculture, Conservation and Ecotourism: Examples from the Field*, ser. Issues in Agroecology – Present Status and Future Prospectus. Dordrecht: Springer Netherlands, 2011, vol. 1, ISBN: 978-94-007-1308-6. DOI: 10.1007/978-94-007-1309-3.

[13] A. E. Eiben and J. Smith, "From evolutionary computation to the evolution of things," *Nature*, vol. 521, no. 7553, pp. 476–482, May 2015, ISSN: 0028-0836. DOI: 10.1038/nature14544. arXiv: arXiv:1011.1669v3.

[14] M. Bonnave, G. Bleeckx, J. Rojas Beltrán, P. Maughan, M.-C. Flamand, F. Terrazas, and P. Bertin, "Farmers' unconscious incorporation of sexually-produced genotypes into the germplasm of a vegetatively-propagated crop (Oxalis tuberosa Mol.)," *Genetic resources and crop evolution*, vol. 61, no. 4, pp. 721–740, Apr. 2014, ISSN: 0925-9864. DOI: 10.1007/s10722-013-0068-z.

[15] G. Charmet, "Wheat domestication: Lessons for the future," *Comptes rendus biologies*, vol. 334, no. 3, pp. 212–220, Mar. 2011, ISSN: 16310691. DOI: 10.1016/j.crvi.2010.12.013.

[16] P. M. A. Bourke, "The Use of the Potato Crop in Pre-Famine Ireland," *Journal of the statistical and social inquiry society of ireland*, vol. 12, no. 6, pp. 72–96, 1968.

[17] C. Ó. Gráda, "The Lumper Potato and the Famine," *History ireland*, vol. 1, no. 1, pp. 22–23, 1993. DOI: 10.2307/27724042.

[18] J. Kelly, *The graves are walking : the great famine and the saga of the Irish people*. Henry Holt and Co, 2012, p. 397, ISBN: 9780805091847.

[19] C. Ó. Gráda, *The Great Irish Famine*. Cambridge: Cambridge University Press, 1995, ISBN: 9781139170970. DOI: 10.1017/CBO9781139170970.

[20] J. S. Duncan, *In the Shadows of the Tropics. Climate, Race and Biopower in Nineteenth Century Ceylon*, ser. Re-materialising cultural geography. Taylor & Francis, Mar. 2007, p. 212, ISBN: 9780754672265. DOI: 10.1111/j.1467-9493.2008.00355.x.

[21] M. M. Caldas and S. Perz, ""AGRO-TERRORISM? THE CAUSES AND CONSEQUENCES OF THE APPEARANCE OF WITCH'S BROOM DISEASE IN COCOA PLANTATIONS OF SOUTHERN BAHIA, BRAZIL"," *Geoforum*, vol. 47, pp. 147–157, Jun. 2013, ISSN: 00167185. DOI: 10.1016/j.geoforum.2013.01.006.

[22] S. B. Brush, *Genes in the Field: On-farm conservation of crop diversity*. Ottawa, Canada: International Development Research Centre, 1999, pp. 1–301, ISBN: 0889368848.

[23] G. Pask, *The Colloquy of Mobiles*, Interactive Installation, London, UK, 1968.

[24] E. Ihnatowicz, *The Senster*, Interactive Sculpture, Eindhoven, NL, 1970.

[25] H. Cohen, *AARON*, 1973.

[26] D. Jolliffe, *Untitled Ball*, Montreal, 1993.

[27] C. Utterback, *Untitled 5*, 2004.

[28] R. Glynn, *Performative Ecologies*, Interactive Installation, 2008.

[29] P. Beesley, R. Gorbet, and R. Armstrong, *Hylozoic Ground*, Venice, 2010.

[30] D. Kadish, "Subtle Emergences," Master of Fine Arts, University of British Columbia, 2015.

[31] R. Ascott, "Behaviourist Art and the Cybernetic Vision.," *Cybernetica, journal of the international association for cybernetics (namur)*, vol. IX, no. 4, 1966.

[32] H. Cohen, "The Art of Self-Assembly: the Self-Assembly of Art," in *Dagstuhl seminar on computational creativity*, Dagstuhl, Germany, 2009.

[33] P. Beesley, Z. A. Ilgün, G. Bouron, D. Kadish, J. Prosser, R. Gorbet, D. Kulic, P. Nicholas, and M. Zwierzycki, "Hybrid Sentient Canopy: An implementation and visualization of proprioceptive curiosity-based machine learning," in *Posthuman frontiers: Data, designers, and cognitive machines: Proceedings of the 36th annual conference of the association for computer aided design in architecture*, Ann Arbor, Michigan, 2016, pp. 362–371.

[34] C. G. Jones, J. H. Lawton, and M. Shachak, "Organisms as Ecosystem Engineers," *Oikos*, vol. 69, no. 3, p. 373, Apr. 1994, ISSN: 00301299. DOI: 10.2307/3545850.

[35] T. Grose, "Garden-Variety Robot," *Asee prism*, p. 12, Dec. 2016, ISSN: 1056-8077.

[36] R. L. Aronson, "FarmBot: Humanity's open-source automated precision farming machine," 2013.

[37] D. Kadish and L. Beloff, "Hybrid hangouts : Embedded values in hybrid ecologies of plants, people and robots," in *First global radical relevances conference*, Espoo, Finland, 2017, [ACCEPTED].

[38] N. I. Vavilov, *Origin and geography of cultivated plants.* Cambridge University Press, 2009.

[39] M. Simon, "Robots Wielding Water Knives Are the Future of Farming," *Wired*, pp. 1–11, May 2017.

[40] J. Liang, M. Zhou, P. C. Tobin, A. D. McGuire, and P. B. Reich, "Biodiversity influences plant productivity through niche–efficiency," *Proceedings of the national academy of sciences*, vol. 112, no. 18, pp. 5738–5743, May 2015, ISSN: 0027-8424. DOI: 10.1073/pnas.1409853112.

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AIA. Artificial intelligence for art

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Abstract

We observe the success of artificial neural networks in simulating human performance on a number of tasks: such as image recognition, natural language processing, etc. However, there are limits to state of-the-art AI that separate it from human-like intelligence. Humans can learn a new skill without forgetting what they have already learned and they can improve their activity and gradually become better learners. Today's AI algorithms are limited in how much previous knowledge they are able to keep through each new training phase and how much they can reuse. In practice this means that it is necessary to build and adjust new algorithms to every new particular task. This is closer to a sophisticated data processing than to real intelligence. This is why research concerning generalisation are becoming increasingly important. Processes such as intuition, emotions, planning, thinking and abstraction are a part of processes, which occur in the human brain. Abstraction allows for making analogies, coding relations and relations between relations.

Keywords

Artificial, intelligence, art, AGI , Recurrent Neural Network

Generalization is a process in which the brain observes that a certain fact referring to a set of objects, refers to a greater set of objects. Processes occurring in the brain have an extremely plastic and dynamic character and cannot be reduced to one basic construction and operation. Many processes have very distributed character, for instance memories are not located in a particular place; the brain has holographic character [Pribram 1991]. A special role of a kind of creators is played by random processes, which allow for collision and splitting of structures, and leaps between different levels of generality. A generalization in AI means that system can generate new compositions or find solutions for new tasks that are not present in the training corpus. General Neural Model and intelligent agent should have very general learning capabilities, should not just be able to memorize the solution to a fixed set of tasks during creating of stories, but learn how to generalize to new problems it encounters. It can generalize problem in the sens that solving one or more of tasks should make solving other task easier. There is domain called AGI where will be possible to find solutions for this problems.

Artificial general intelligence (AGI) describes research that aims to create machines capable of general intelligent action. "General" means that one AI program realizes number of different tasks and the same code can be use in many applications. We must focus on self-improvement techniques e.g. Reinforcement Learning and integrate it with deep learning, recurrent networks, etc.

Recurrent Neural Networks

Models of sequential data, such as natural language, speech and video, are the core of many machine learning applications. Recurrent Neural Network is a powerful model that learns temporal patterns in sequential data. A recurrent neural network (RNN) is a class of artificial neural network where connections between units form a directed cycle, meaning that Recurrent Neural Network contains feedback connections, connections from any unit to itself. This allows it to exhibit dynamic temporal behavior. Unlike feedforward neural networks, RNNs can use their internal memory to process arbitrary sequences of inputs. This makes them applicable to tasks such as handriting recognition, speech recognition and after modification as a performative and/or compositional tool for composer and musicians. Creating of feedback in RNN provides interesting creative posibilities, recurrent neural networks can evolve to a unstable states and they can create chaotic or random outputs. Chaotic behavior of recurrent neural networks has been observed before eg. by Maas (Maas et all, 1990).

It was shown that smooth variation of one of the parameters of the original map gives rise to period-doubling bifurcations. Feedback and chaotic behavior of RNN causes that some artists and composers are starting to use RNN in their artistic work. For example CTRNN Continuous Time Neural Networks are implemented in modular extensible computer music platforms such as Supercollider, Pure Data, MaxMsp. Sound or video parameters can evolve and be formed by using Recurrent Neural Networks. Photo CTRNN in action RNN models can be uses to tasks such as handwriting recognition, speech recognition, natural language processing, video recognition, etc. Natural language modeling has been widely studied in the past (Goodman, 2001b; Young et al., 1997; Koehn et al., 2007). In particular, models based on RNN have been very successful in automatic speech recognition (Dahl et al., 2012), language modeling (Mikolov, 2012) and video classification (Simonyan & Zisserman, 2014).

RNN represents time recursively. For example, in the simple recurrent network, the state of the hidden layer at a given time is conditioned on its previous state. This recursion allows the model to store complex signals for arbitrarily long time periods, as the state of the hidden layer can be seen as the memory of the model. However there is a problem of learning long term patterns in Recurrent Neural Networks. Recurrent networks was difficult to train using simple optimizers, such as stochastic gradient descent, due to the vanishing gradient problem. For example the sigmoid function have a gradient which is close to zero almost

everywhere or the gradient can be backpropagated through time, its magnitude is multiplied over and over by the recurrent matrix. If the eigenvalues of this matrix are small (i.e., less than one), the gradient will converge to zero rapidly. Learning longer term patterns in real data, such as in natural language, is possible using gradient descent by using a structural modification of the simple recurrent neural network architecture. Many modifications were proposed to deal with the vanishing gradients eg. the long short term memory (LSTM) recurrent neural network (Hochreiter & Schmidhuber, 1997) is a modified version of recurrent network with gates which control flow of information to hidden neurons. This allows the network to potentially remember information for longer periods.

Most of the research on the use of AI in interactive applications concerns computer games, beginning with traditional two-player adversarial games like tic-tac-toe and extending to modern strategy games. This type of research however, has a limited application in storytelling or art, because the goal of AI agents in these games is to maximise reward, which often fails to advance the narrative threads and almost entirely overlooks the creation of interesting scenarios or compositions. Magerko (2009) conducted research with theatre performers to explore how to create scenes in real time without a preexisting scenario. Unfortunately, the basic conclusion of this research is that the actor should act on the basis of a huge set of initial scripts, which contain expectations as to what people do in different scenarios. There have been several attempts to implement the above approaches through introducing text into the game, building chatbots or intelligent assistants. However, these approaches have a limited scope, because they do not encompass the numerous phenomena known in natural language, such as the creation of metaphors, analogies and generalisations, which are crucial for human thinking and for creating stories. If the AI program works in order to create a story, it must be prepared to understand everything that the human might think and must be able to communicate in a natural language. Neural language models have garnered research interest for their ability to learn complex syntactic and semantic representations of natural language (Sutskever et al., 2014). Recurrent Neural Network (RNN) is a powerful model that learns temporal patterns in sequential data. Wen et al. (2015) proposed a RNN approach to the generation of utterances from dialog acts but their system requires one to preprocess the data.

Deep Reinforcement Learning

Thinking about programs in terms of binary codes and about functioning of the brain in terms of self-improvement through optimization of the codes, we may perceive the search for brain model as the search for best learning algorithms, and as an attempt of creating best predictions. The most interesting AI method is Reinforcement Learning. The brain works without deus ex machine, the rule of its organization is the rule of the shortest description, which allows for choosing shortest models of reality. A program is a set states that represents a given situation and the set of operators (actions) and which allows for transition between states. A general framing of the space of transition between states is the Hidden Markov model, in which every transition has a certain probability of occurrence. Real states of the world are unknown, they can only be approximated. We obtain data through sensors from the environment. The data is recorded in the form of vectors. Markov models are static: the agent is unable to model his actions, he cannot change the world he is in. An extension of this model are Markov Decision Processes. MDP generalizes Markov models by introducing additional possibilities: consequences of actions may not be know a priori, even if the consequences of actions are known, their value is unknown, the value of the action is difficult to predict, because the reward is often delayed. In this situation the model of best actions is not known, but it has to be discovered. The agent uses certain actions and analyses their results. The actions which bring reward are not known, but they have to be discovered by trial and error. Theories that apply the above method are called models of reinforcement learning. Models of reinforcement learning allow the agent to choose adequate decisions on the basis of exploration of the environment that changes dynamically. By examining the space of states that bring reward, the agent may learn from the history of his previous actions. The most interesting situation occurs when the space of states is only partially observable. Reinforcement learning works, because the agent can make local improvements in order to increase the reward.

A deep neural network (DNN) is an artificial neural network with multiple hidden layers between the input and output layers. Each successive layer uses the output from the previous layer as input. It is system of multiple layers of nonlinear processing units that learns of feature representations in each layer and form a hierarchy from low-level to high-level features. Deep learning networks can be applied to any problem for example in language, sound or image processing. Deep and recurrent neural networks are powerful models that achieve high performance on difficult pattern recognition problems in vision, and speech (Krizhevsky et al., 2012; Hinton et al., 2012; Dahl et al., 2012). Reinforcement Learning can be used to improve dialogue managers, e.g. for transitions between dialogue states (Rieser and Lemon, 2011)1, for non-goal-orientated dialogues (Li et al., 2016), for bot-bot dialogues and for inventing new languages by agents (Das et al., 2017). Photo2 using AI agents during performance.

Deep Learning is becoming more and more popular method. Commercial using of Deep Learning models is often associated with using data from massive data centers eg. Google, Facebook and it is difficult to verify if used model is really intelligent and can generalize knowledge or if it is only sophisticated complex automated system that uses the brute force method based on unlimited access to data generated by users. The application of deep learning in art looks uninteresting because constructed networks simulate only human behaviors; in this case, they use art history databases to generate objects that imitate artworks from the past.

Therefore, if we want to make the next shift (challenge) we have to put more emphasis on research

concerning self-improvements of system eg. different types of algorithms associated with reinforcement learning and perform interesting fusions of reinforcement learning with deep learning. The goal is to incorporate the reinforcement learning process into deep learning for creating a system that will have an ability to learn and self-improve. Another way to do this is to study the methods connected with randomness and to integrate them into neural networks. Both of these approaches are perfectly complementary because there is no interesting self-improvement system without the clever use of random generators and vice versa.

Kingdom of Randomness

To obtain interesting results in music and art we need randomness. Randomness is important when you want the Neural Network from the same input to create different possibilities as an output, without generating the same output over and over again. Therefore it is different than in science, which is all about grouping and clustering. In art and music we don't want to endlessly obtain the same result. When you are composing sound or images, you don't want the neural network program to create the same sets of sounds and images; instead, you need creativity and variability. One of the solutions is to parametrize NN outputs with the use of probability distributions. A different way is to add noise directly to NN, instead of modeling the distribution parameters. Paradoxically, in such NNs, the more randomness during training, the better the results. Good random generators allow to avoid situations, when Neural Networks gets fixed in local minima. The importance of well-designed random initialization and momentum in deep learning was observed for example by Sutskever and Hinton (2016).

Random number generators are applied in many domains for instance in music programs, computer games etc. In numerous compilers random number generators are used as ordinary functions. The problem with these generators however is that they never produce random numbers, not even numbers that approximately appear to be random. Limits of our perception makes us consider sequences of numbers they produce as random, and maybe in the case of games of chance this ’randomness’ is sufficient, but in cryptography it is hopelessly not random and completely useless. No random number generator build with the use of computer (or abstract Turing machine) will generate random numbers. It is impossible to obtain a sequence of random numbers with the use of computer. Computers are entirely deterministic machines: we put something in, subsequently we subject it to entirely predictable operations and receive something “new”. If we put the same thing into the computer again (in different times) we will get exactly the same result. If we put the same input sequence into two different computers, we will also gain the same result. The number of states of a computer is finite.

The result is completely determined by input data and functions we use. Every random number generator build with the use of computer is, by definition periodic. Of course, such periodic generator is predictable. If it is predictable it can’t be random. A real random number generator requires a random input. A computer does not have random input. The only possibility when it comes to randomness in case of computer science techniques is the creation of pseudorandom number generators (PRNG). They can be useful in some applications if the period of the obtained sequence of numbers is long enough, which means that numbers will repeat but after a relatively long time. The beginning of this sequence should consists of numbers that remind of random numbers. Many pseudorandom generators have been built, which are periodic, but the potential periods have the length of 2256 bites. However even generators with very long periods create strange correlations between numbers. Unfortunately every deterministic generator will produce them if it will be used in a specific way, but there are ways of minimizing the number of correlations. Structure of PRNG consists in using a certain number and recurrence function. We start with a certain number (seed). Then we subject it to mathematical function. We obtain a number, which is again subjected to the same function. We repeat the procedure.

We obtain pseudorandom sequence of numbers. The process is constructed in such a way so that the numbers repeat after some time. How fast it will occur depends on the function used. At some point PRNG will produce the number from which we started. From this moment the numbers will repeat periodically. In weak generators the periods are short, in good ones very long, which means that the sequence of numbers may repeat after milliards of operations. A choice of good, incompressible seed has a crucial importance in cryptography and art. When the secret cypher key is generated in a pseudo-random manner, if we get the seed, we also get the key. In cryptography we need really random number sequences. This means sequences, which can’t be repeated: it is impossible to repeat a sequence of bits produced by such generator. This problem can be examined on the example of creating a key. Keys should be generated in such a way, so that the sequence used is really random. Otherwise, the adversary may get the copy of the key generator and break the given cryptographic system. Random number generator should be subjected to tests, which consist in attempts of compressing generated sequence. One of the popular methods of generating random numbers is obtaining bits from computer clock. It doesn’t however guarantee good quality randomness because computers use many mechanisms of clock synchronization. One shouldn’t use too many bits generated through this method because using the same procedure several times effects in the emergence of correlations, which are easy to find. Randomness obtained from measuring time when the keyboard remains idle is another popular method, which consists in measuring short time intervals between keyboard presses. However a fundamental flaw of this method is that the generated keys are usually very short. A good way of obtaining big number of random numbers is to use bits from the surrounding world, for example using atmospheric

noise. This method requires specialized measuring devices that allow for measuring time between events.

Generators that use thermal noise (e.g. from semiconductor material), as well as those that use computer disk drive, and measure time necessary for reading set of data from the disk have been created. Air turbulences influence variations in the rate of disk rotation. There are also other methods of obtaining numbers from noise, which consist in measuring the position of the machine, mouse, screen behavior, components of currently displayed image, CPU loads, microphone signal etc. Fundamental flaw of these methods is that there may occur some repeatable correlations introduced by measuring devices. These devices are often synchronized in order to enable correct, repeatable activity of the computer. A very good method is using radioactive material and Geiger counter in which, during radioactive decay the time between following clicks is always different. Randomness from the quantum level obtained from radiation emitted during decay of radioactive material has an extremely good quality. One may obtain a big number of random bits from Geiger counter and use it as a key. We use a sequence of the length of for instance 256 bits as an input of one-way hash function. Hash function is a mathematical function that transforms a sequence into a sequence of a precise length. We use one-way function, which means that it is easy to count the shortened sequence on the basis of input sequence but it is impossible to do it the other way round. Quantum mechanics claims that in the real world, randomness occurs in a pure form. In quantum states there is fundamental randomness and it cannot be changed. If we interpret the formulas of quantum mechanics we can say, that elementary particles do not exist in any precise location. They exist in many locations simultaneously, with a certain probability of occurrence.

Photo 3 Quantum Enigma

Mind uploading

Mind Uploading (MU) is the process of copying the brain from natural substrate to artificial one. MU is carried out through scanning the structure of a brain and building an appropriate informatics model, which is true to the original and after launching it on an adequate hardware, behaves like the original brain. By emulation we understand a 1 to 1 model, in which all properties of the system have been retained. Emulation, copying and modifying of the brain will bring explosion of diversity. We are very good at creating maps of the human brain in different scales (we have increasingly better techniques of scanning brain structures in different scales), however our informatics brain models are supremely primitive. There are interesting consequence of building MU in the future. People will become more heterogenous, more varied in terms of physical and cognitive dimensions. Another consequence will be the change of value system: life will become less valuable. Life will become "cheap" because we will be able to emulate it. Why not participate in a risky game, when in a worst case, I can activate the backup copy of myself.

The belief "inimmortality" may change our behavior. Analogy: in computer game we value our life less than in real life, because we can reset it anytime. After the mind up- loading turning point, freezing, copying, slowing down and modifying of the brain will become acceptable. Of course there will be other consequences: ethical, political, economic, medical, religious and cultural. I highlighted value of life, because it has influence on other values. Other consequences of MU are connected with the notion of identity and consciousness. Can human consciousness be emulated and transferred? Does the transfer preserve consciousness? People are conscious, which means that they have conscious, subjective experiences. They lie at the center of our mental life and give our life meaning. If we loose consciousness, in a significant sense we cease to exist. If brain emulation is devoid of consciousness, then it probably doesn't exist at all, at the very least it is zombie existence. The problem is complex because our understanding of consciousness is very weak, we do not know how brain's activity makes consciousness possible.

References

Bates J. 1992. Virtual Reality, Art, and Entertainment. Presence Teleoperators Virtual Environ 1:133–138.

Dahl, G.E., Yu, D., Deng, L., and Acero, A. Context- dependent pretrained deep neural networks for large- vocabulary speech recognition. Audio, Speech, and Lan- guage Processing, IEEE Transactions on, 20(1): 30–42.

Das A., Kottur S., Moura J., Lee S. 2017. Learning Cooperative Visual Dialog Agents with Deep Reinforcement Learning. arXiv preprint arXiv:1703.06585.

Hinton, G., Deng, L., Yu, D., Dahl, G., Mohamed, A., Jaitly, N.,

Senior, A., Vanhoucke, V., Nguyen, P., Sainath, T., et al. Deep neural networks for acoustic modeling in speech recognition. IEEE Signal Processing Magazine, 2012.

Hochreiter S., Schmidhuber J.1997. Long short-term memory. Neural Comput. Nov 15;9(8):1735-80.

Krizhevsky, A., Sutskever, I., and Hinton, G. Imagenet classification with deep convolutional neural networks. In Advances in Neural Information Processing Systems 25, pp. 1106–1114, 2012.

Li J., Monroe W., Ritter A., Galley M., Gao J., Jurafsky D. 2016. Deep Reinforcement Learning for Dialogue Generation. arXiv preprint arXiv:1606.01541.

Maas H. L. van der, Verschure P. F. M. J., and P. C. M. Molenaar (1990), A Note on Chaotic Behavior in Simple Neural Networks, Neural Networks, Vol. 3, pp. 119–122.

Magerko B., Manzoul W., Ried M. 2009. An Empirical Study of Cognition and Theatrical Improvisation. In: Proc. Seventh ACM Conf. Creat. Cogn. ACM, pp 117–126.

Pribram K. 1991. Brain and Perception: Holonomy and Structure in Figural Processing, Lawrence Erlbaum Associates.

Riedl M., Bulitko V. 2013. Interactive Narrative: An Intelligent Systems Approach. AI Mag 34:67–77.

Rieser V., Lemon O. 2011. Reinforcement Learning for Adaptive

Dialogue Systems: A Data- driven Methodology for Dialogue Management and Natural Language Generation. Springer Science & Business Media.

Schechner R. 1998. Performance theory, Routledge New York.

Sutskever I., Martens J., Hinton G. E. 2011. Generating text with recurrent neural networks. In Proceedings of the 28th International Conference on Machine Learning (ICML-11). pages 1017– 1024.

Sutskever I., Martens J., Dahl G., Hinton G. 2016. On the importance of initialization and momentum in deep learning. Proceedings of the 30th International Conference on Machine Learning, PMLR 28(3): 1139-1147.

Wen T., Gasic M. 2015. Stochastic language generation in dialogue using recurrent neural networks. In Proceedings of SIG-dial for Computational Linguistics.

Shards: Multi-dimensional Stereoscopic Cubism in Virtual Reality

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Keywords
Virtual Reality, Cubism, Stereoscopic, Spatiality, Composition, Hyper dimensional, Hybridity, Interaction, Heterotopia.

Abstract
This paper discusses the artistic and technical innovations in the depiction of non-naturalistic stereoscopic space in the virtual reality experience Shards. In Shards, there are four different realities existing simultaneously, but all are initially invisible to the user. To experience them, the user can create viewport cubes and throw them into the area around them to reveal 3D portholes into those spaces. The user can view multiple intersecting realities simultaneously. Shards is an active, playable experience, where participants are encouraged to explore and reveal the environment. Through the act of exploration, users generate Cubist-inspired interpretations of perspective and dimensionality, contrasting multiple stereoscopic viewpoints in one composition. A radical approach to the use of 3D geometry with stencil shaders creates a unique spatial environment. The conceptual relationships to hyper dimensionality and heterotopia are also examined.

Introduction

Though techniques of stereopsis have existed since at least the mid 1800's, most of the popular interest in the format has tended to focus on replicating normative spatial understanding and experience, as opposed to exploring more radical approaches of synthetic space. While there are some artists who have exploited the creation of alternative stereoscopic constructs for artistic expression, the dominant paradigm remains within the general approach of depth realism.

Stereoscopic illusion offers many possibilities for creative reconfiguration of the senses when approached from a standpoint of intentional manipulation and disruption, and looking beyond normative representations of depth. Shards presents one such project that plays with ideas of hyper dimensionality, Cubism, and Heterotopia in its conception and uses a unique technical approach to explore artistic possibilities.

Experience

Shards is an interactive room-scale virtual reality art experience built using the Unity game engine and designed for the HTC Vive. The participant is initially presented with a completely empty environment with a light blue background. However, there are four different environments existing simultaneously within that space, five if you count the meta-environment that acts as a place between worlds.

To experience them, the participant must generate and throw cubes into the area around them to reveal 3D shards of those sub-spaces. The cubes respond to the initial velocity of how they are released, colliding with others, creating chain reactions of movement and eventually coming to a rest in the environment, suspended around the viewer.

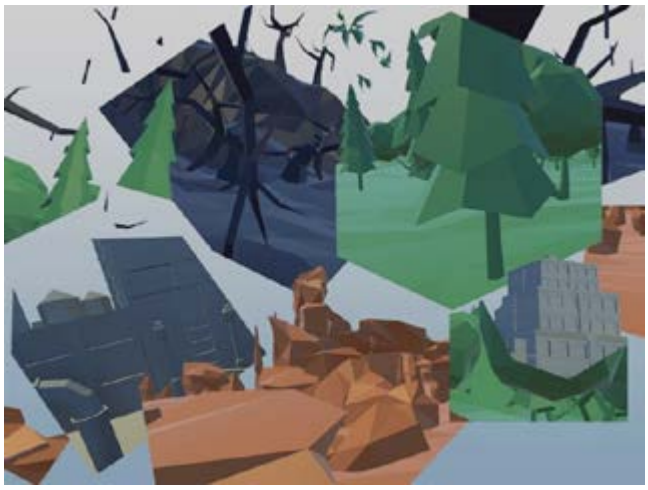

Fig 1. *Shards v2.0,* 2017, XXXX XXXX, virtual reality experience, ©XXXX.

Participants are never able to ever see the whole picture. Rather they create a dynamic, multi-dimensional spatial composition as they populate the environment with fragments of sub-realities. Some participants, after experimenting for a time with the controls, try holding up a cube in front of their face and using it as a viewing frame to see the whole of one sub-space. However, even this tactic does not result in a total continuity, as the user is self-aware they must hold onto the cube a window to see through, and

there will still be significant area in peripheral vision that does not show that space. (Fig2)

Fig 2. *Shards v2.0,* 2017, XXXX XXXX, virtual reality experience detail, ©XXXX.

Sub Realities

Each sub-environment uses five compositional elements in its representation consisting of a colour scheme, a low-poly geometry landscape, a particle system effect, a soundscape, and a haptic signature. It plays with ideas of history, as if the same place was being viewed through four different moments in time. The barren rocks, the green forest, the burnt forest, and the cityscape all coexist.

Colour scheme. Initially a limitation of the technology used, this constraint became a way to makie bold choices in defining each of the environments. Each world has an immediately strong visual cue separating it from the others. All the colours chosen were selected in direct relation for their symbolically representative qualities matching their environment. I.e. – green for the live forest.

Low-poly landscape geometry set. The objects that define the environment in each world are all a hardedged, low-poly style. This provides a consistent but minimalistic aesthetic for the overall experience. The sub-geometries are not aligned with each other, but each presents a discrete world.

Particle system effect. Early experimentation with this project, revealed a more engaging and lively experience with the addition of a falling-rain particle system to the burnt forest world. Considering each subreality is more interesting, as the particle elements would enter from one side and escape out another in a surprising manner. The particle systems are all-geometry based, meaning they rely on polygon objects rather than cards with images or other effects, and are thematically related.

Soundscape. To deepen the juxtaposition between the multiple environments and unified whole of the experience, a soundscape was associated with each space. Each track is triggered to begin when a cube is placed in the world, and the volume level attenuates with the distance from the participants position. Over time, they create a layered sound experience that echoes and compliments the fragmented visual composition. **Haptic signature.** Each space also has associated with it a touch feedback response. This is generated when the user spawns one of the cubes, and when they reach out with the controller and touch the space where one of the cubes already exists.

Stereoscopy

When content is displayed in VR that does not match our physiologically determined default settings, that is, what is presented to the body sensor does not correlate well with our biological systems and experiential conditioning, we generally describe it as somewhere between slightly odd to downright painful, depending on the severity of the mismatch and the particular perceptual systems targeted. However we are able to adapt to some conditions over time, such as a navigable VR world being presented through virtual lenses that do not match the human standard of vision (Jerald, 2015). Shards intentionally stretches some normal practices of stereoscopic media. However, the stereoscopic abnormality of the Shards experience is fundamental to its artistic design. Though some idea of the spatial abnormality is conveyed in a 2D snapshot, the true nature of the experience cannot be fully understood without viewing it in stereoscopic 3D.

Technical

The innovative stereoscopic technique in Shards works via a novel application of a stencil mask. An example of a more common application of this would be to use a window analogy. For instance, one could look through a window onto another world, or through a looking glass, etc. Significantly, Shards expands on this technique in two important ways. The first is to use full 3D geometry as a masking object rather than a 2D planar mask. The second is that the geometry revealed by the mask appears both behind and in front of the object doing the masking. Both concepts are explained in greater detail below, after a more comprehensive treatment of the underlying stencil shader technique in general.

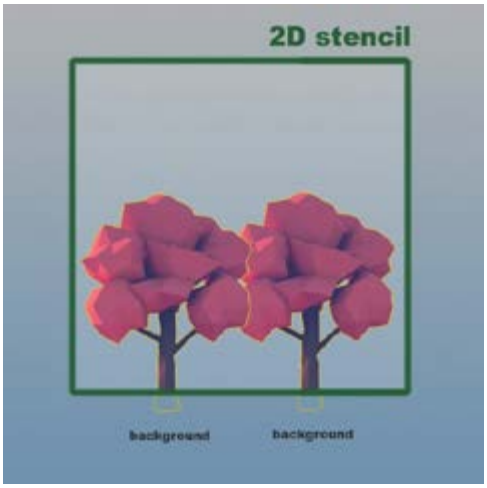

Fig 3. *2D Stencil illustration*.

Stencil Shader

To explain the workings of the stencil shader approach, let's continue with the simple example of a window revealing a different world behind it. (Fig. 3) In this case, we would have a flat 2D plane in the scene, behind which we would see 'another world', being a set of geometry. Shaders calculate RGB and Z values for the pixels on the screen, being the colours and depth position of elements at that point on the screen. The stencil works through means of a general-purpose buffer, allowing storage of an additional integer for each pixel drawn to the screen that is an arbitrary value. That buffer of values allows for other shader passes to query the contents at that point on the screen, and use that information in the compositing pass of the rendering.

This works in a two-step process. (Zucconi) Firstly, a vertex and fragment shader that initializes the stencil buffer is placed on the 2D plane. For that 2D area on the faces of the window, a stencil number for that whole area is recorded in the buffer. Secondly, a material is applied to the geometry that is located behind the 2D window plane. This material checks to see if the stencil buffer has a specific value (as set by the stencil mask) and renders only if they match. Correspondingly, the geometry shader associated with that number is allowed to 'show through' in that square by means of querying the values in the stencil buffer. (Aitchison, 2014) So, the shader allows for the object mesh to be visible where it is applied, but restricts its material properties, meaning that everything that has that shader applied must also have the same surface rendering characteristics.

Multiple Realities

So far, we have discussed only the case of having one set of geometry revealed behind the 2D window. However, this stencil technique allows for multiple geometries to be present in the scene at the same time, but only rendered as desired. This means that one window can easily reveal an arbitrary number of alternate world geometries behind it. It is by these means that Shards presents the viewers with four alternate sub-realities.

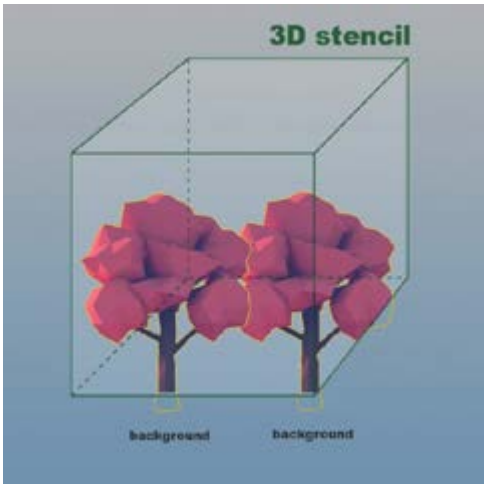

Fig 4. *3D Stencil illustration*

3D Geometry as Mask

Now we come to the crucial innovations used in the Shards project. The first of which is using full 3D geometry as the masking object. Instead of using a simple, static 2D plane as a window, interactive 3D cubes are used.

Full Z Depth Reveal

The second innovation is the use of intermediate distance masks to allowing rendering of both near and far depth elements. In Shards, this means that any of the four sub reality environments in shown not only behind the revealing cube, from the point of view of the participant, but in forward of that position as well. (Fig4) This phenomenon is non-naturalistic and unexpected, as one assumes a windowing object would only reveal the scene in the distance. Unlike revealing the foreground in a 2D depiction, the stereoscopic 3D foreground reveal has a much more visceral and personal, and embodied impact on the participant. (Ross)

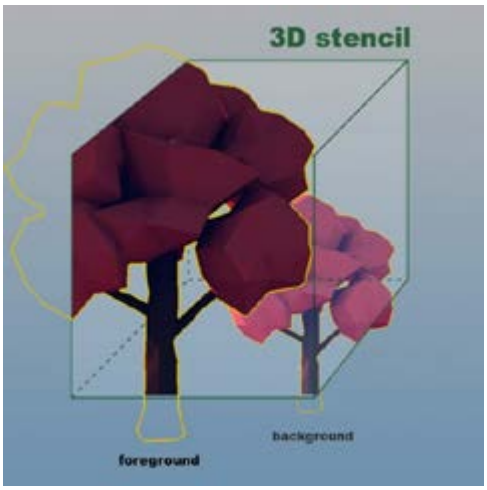

Fig 5. *3D Stencil with Foreground illustration.*

Conceptual Grounding

This approach seeks to explore radical re-formations of stereoscopic media practice that challenge normative spatial understandings and accepted conventions. Ideas pursued in the artistic movement of Cubism are of historical influence, as well as more modern VR practices in attempting to depict hyper dimensional spaces. Finally, the construction of heterotopic spaces provides a useful metaphor for the situation of the participants emplacement in Shards.

Cubism

Shards is partially inspired by the practices of Cubism, but re-imagined in a 21st century context in a new media format that allows for more radical and extended expression of some of its core explorations. The processes of Cubism involved analysing spaces and objects and re-imagining their expressive power through the reassemblage of multiple views. Simultaneity of experience, and the fusing together of time and space into a meta-composition of the subject figure prominently in Cubist approaches. It goes beyond Euclidian ideas of single point perspective and attempts to provide a larger context for interpretation and experience. (Henderson, 2013) "This is understood by the cubist painters, who indefatigably study pictorial form and the space which it engenders. This space we have negligently confounded with pure visual space or with Euclidian space."(Gleizes)

In addition, the cubists were very interested in the experience of physical touch. "The attempt to capture more real aspects of forms, rather than their accidental, perspectival displacement, came through touch, which keeps all distances and relationships objective. In fact, a review of early Cubist theoretical writings will demonstrate the ubiquity of ideas of tactile values."(Verstegen, 2014) They knew the primacy of touch was more real than sight, but by attempting to translate touch to sight the depiction becomes less naturalistic visually. Shards uses the interactivity of the controller to give participants some haptic relationship with the experience of the spaces.

Hyper dimensionality

There has been a fascination with higher dimensions and alternate understandings of space in modern art since the early 20th century in movements such as Cubism, Futurism, and Russian Supremacism (Henderson, 2009). As Linda Dalrymple Henderson has extensively documented, popularized theories of the 4th dimension being a layer of space (rather than as clarified later from Einstein as time), were very influential in the subject matter and artistic approach of painters such as Duchamp, Braque, and Picasso. This served as a gateway to liberating space from the constraints of naturalistic depictions. Jean Metzinger and Albert Geizes spoke specifically of folding three dimensional spaces together through the idea of the fourth dimension in the artistic manifesto *Du Cubisme*.

In 1991, very early in the history of virtual reality, Marcos Novak posed the question "What would it be like to be inside a cubist universe?" (Benedikt, 1991). In his project *Dancing with the Virtual Dervish* a fourdimensional virtual world was incorporated both in a large-scale projection to the audience and to the performer who was receiving it in a head mounted display he was wearing.

Another project that directly addresses the situation of attempting to perceive higher dimensional space in virtual reality is an interactive experience designed for the University of Chicago's Electronic Visualisation Lab CAVE system. In this work, the user is given the opportunity to navigate through a four dimensional grid of hypercubes, using a handheld controller to rotate through the planes of the space. (Aquilera, 2006) One of the specific design methodologies of this project was to enable a human to have control over the physical navigation of the space through the movement of their body, her theory being that an understanding of higher dimensional space could be "internalized like a dance pattern". Thought the technology used presented a completely synthetic rendering to the user, the artist philosophically presented the work as a type of augmented reality, or seeing further through the lens of technology.

Shards takes an alternate approach to exploring a hyper dimensional space. Rather than a mathematically consistent geometric depiction, Shards fragments space into views of multiple sub dimensions that can be manipulated by the participant. Through stereoscopic disruptions of space, confounding depth cues between near and far, it offers a disruptive visceral experience by warping and disrupting the viewers sense of continuous spatial environment. As Rodrigáñez and

TedeshchiniLalli describe, the evolution of mathematics, geometry, and spatial representation in the arts share a cultural context and progression, each reflecting to some extent trends in the other, and in many cases directly informing advanced thoughts and insights across the traditional boundaries of disciplines. In particular, the use of multiple coordinate systems acting simultaneously within the same work of art is noted: "The combination of local and global tools is not exclusive to mathematics or painting. In fact during the twentieth century it became one of the essential abstract features of Western culture."(Rodrigàñez & Tedeschini-Lalli, 2005)

Heterotopia

The non-naturalistic stereoscopic scene with its conflicting spatial cues and composed of multiple subrealities puts the participant in a space of otherness. The user does not know what exists in the space before generating the reality cubes to see through. What appears to be a void is in fact full or overfull, the user will discover, after they have released cubes into the environment. This presents a dichotomy, a contradiction, and a surprise. An ontological paradox is created by means of generating these viewpoints that relates to the concept of heterotopia, this being a space of otherness that exists outside of, or in opposition to, dominant spaces. The heterotopia created is both hierarchical and dislocated, situating the participant as an estranged outsider while simultaneously giving a limited sense of control.

Summary

Shards poses the question - how can we expand our experience and expression of spatialized media beyond what we currently understand? As Oliver Grau traces in his book *Virtual Art from Illusion to Immersion*, the urge to use technologies and advances in scientific understanding of perception and illusion has driven the quest for immersive experiences (Grau, 2004). Immersion and presence are two hallmark points of discussion when it comes to the field of virtual reality. Immersion is the extent to which a VR system presents the user with sensory stimuli that occupies the perceptual channels. These can include visual, auditory, and haptic (touch) based technologies, and usually incorporates interactive and responsive methods. A related concept is that of presence, which is the subjective feeling the user experiences of 'being there' in the Virtual Reality environment.

The current discussion in VR of these predominant goals, immersion and presence, reveals something about the current limited state of thinking regarding its true possibilities. They are seen as the goals of a quality VR experience and are often pursued without questioning their validity as standards. Shards specifically does not seek to provide an experience of immersion or presence per se, but rather uses the technology to explore an altogether different approach. Instead of defaulting to the pursuit of immersion and presence, Shards challenges the body and mind with sensory stimulus and spatial configurations that would be impossible to experience in any other media by harnessing its unique potential. It seeks to move the discussion beyond ideas of simulation and mimesis, and on to expanded perception and imagination.

Morie asserts that the immersed VR user still possesses knowledge of simultaneous embodiment, being aware at some level of both the rendered simulation they currently appear to control and their own physical body still operating in the default reality (Morie, 2007). In Shards, there is no attempt to bypass the knowledge that you are in an explicitly mediated and synthetic experience, but rather to fully acknowledge a hypermediated awareness. As McLuhan argued, the transformation of media technology drives changes in human perception. (McLuhan)

Future Possibilities

Shards represents an initial foray into these concepts and techniques, but there are many intriguing possibilities beyond it. For instance, though the renderings in the cubes inside Shards are of a traditional perspective view, there is no reason they need to be. For instance, any given sub-reality could have a spatial warping applied to the geometry, such as might be found in the parametric distortion found in the Curved World technique that can render an entire mesh environment as if wrapped around a convex or concave curve. (Naskidashvili)

Additionally, both the 3D geometry masking technique and the forward reveal offer much in terms of artistic possibilities. Shards presents an initial investigation, and its approach favours a minimalist, bold approach to articulating these concepts. However, more subtle and complex layering of 3D masking shapes and an interplay between foreground and background perception is explored in the follow-on piece Ghost. In particular, much more complex geometry is used for the 3D masking technique than the simple cubes of Shards.

Bibliography

Aitchison, A. (2014). Using the Stencil Buffer in Unity Free | Alastair Aitchison. Retrieved July 27, 2017, from https://alastaira.wordpress.com/2014/12/27/using-the-stencilbuffer-in-unity-free/

Aguilera, Julieta Johnson, A. (2006). Unfolding Space Thesis. Retrieved July 8, 2017, from https://www.evl.uic.edu/julieta/thesis/

Benedikt, M. (1991). *Cyberspace: First Steps*. Cambridge: MIT Press.

Gleizes, A. (1920). *Du cubisme et des moyens de le comprendre*. Éditions“ La Cible.”

Grau, O. (2004). *Virtual Art: from illusion to immersion*. Cambridge, MA: MIT press.

Henderson, L. D. (2009). The Image and Imagination of the Fourth Dimension in Twentieth-Century Art and Culture. *Configurations*, (1), 131.

Henderson, L. D. (2013). *The fourth dimension and non-Euclidean geometry in modern art*. *Leonardo Books* (Revised ed). Ipswich, MA: Leonardo

Jerald, J. (2015). *The VR Book: Perception and Interaction Design for Virtual Reality*. *ACM Book Series*. New York, NY USA: Association for Computing Machinery, Morgan and Claypool.

Morie, J. F. (2007). Performing in (virtual) spaces: Embodiment and being in virtual environments. *International Journal of Performance Arts & Digital Media*, *3*(2/3), 123–138.

Naskidashvili, D. (2015b). Curved World - Unity Asset Store. Retrieved July 6, 2017, from https://www.assetstore.unity3d.com/en/#!/content/26165

Naskidashvili, D. (2015c). Step by step guide for integrating Curved World effect into custom shader, 2.

Rodrigàñez, C. C., & Tedeschini-Lalli, L. (2005). Local/Global in Mathematics and Painting. In M. Emmer (Ed.), *The Visual Mind II* (pp. 273–307). Cambridge: MIT Press.

Ross, M. (2013). Stereoscopic visuality. *Convergence*, *19*(4), 406–
414. https://doi.org/10.1177/1354856513494178

Verstegen, I. (2014). The Tactility of Early Cubism. *Konsthistorisk tidskrift/Journal of Art History*, *83*(4), 290–302. https://doi.org/10.1080/00233609.2014.921641

Zucconi, A. (2015). Impossible Geometry: Non-Euclidean Cubes - Alan Zucconi. Retrieved January 17, 2018, from https://www.alanzucconi.com/2015/12/09/3873/

Xxx Ghost Forest

Xxx Shards

360° Dance Film: Reflections on the Making of Tidal Traces

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Abstract

Tidal Traces (2017) is a 360° dance film collaboration between filmmaker/media artist Nancy Lee and choreographer/dance artist Emmalena Fredriksson, with sound design/music composition by Kiran Bhumber. This paper accounts for the creative and technical differences of creating a dance film versus 360° dance film, and the conceptual, practical and ethical challenges the artists encountered throughout their interdisciplinary process where 360° video, film and dance intersect.

Keywords

360 dance film, virtual reality, 360 cinema, contemporary dance, dance improvisation, spatial audio, practice-based research, interdisciplinary approach

Introduction

The caveat for creating content for VR and most interactive media art lies in that we cannot predict how each viewer will interact with such media. The narratives, interpretations, and meaning-making they associate with such work can be broadly attributed to their direct interaction, as well as to their individual phenomenological background. This raises ethical considerations both in production and presentation of work. Through the collaborative interdisciplinary research project that became Tidal *Traces* (2017), we examined some of these issues.

Tidal Traces, a 360° dance film, was developed through a one year long Dancelab Residency at The Dance Centre in Vancouver, Canada from September 2016 to September 2017. We, Emmalena Fredriksson and Nancy Lee, were awarded the residency after shooting a DIY demo version in June 2016, which led us to a deeper inquiry and further exploration of the 360° process. The Dance Centre residency included studio space, public talks, workshops and a technical black box theatre lab. The demo film was also presented at Festival of Recorded Movement in Vancouver, June 2017. Halfway through the residency we pitched the project to the National Film Board of Canada's Digital Studio, who commissioned and produced the final version, filmed in July 2017.

Synopsis: *Tidal Traces (2017)*

> By placing the audience in the centre of the performance in an immersive environment, the artists envision a poetic journey where four characters move through a new and uncertain world through a series of dances. Set offshore in the intertidal mudflats of Boundary Bay, the dance is situated with lapping ocean underfoot, for a visual backdrop of sky, horizon and water. Tranquil at first, the comfort of this new world becomes ominous. The tensions that emerge create imagery between beauty and peril. Entangled in this world, the viewer becomes the fourth character, directly composing the dance through their gaze. (National Film Board of Canada, 2017)

In this paper we will speak collectively (we) as well as individually written in Emmalena's, Nancy's and Kiran's first person voice (I) respectively about the choreographic, film, and audio processes of making *Tidal Traces*.

Research Context

Based on online media and popular marketing language, 360° videos are often portrayed and understood as VR to consumers; therefore it is important to allow some flexibility to let 360° video fall under the VR umbrella. We note that the main differences between true VR and 360° videos lie in the viewer's ability to control their experience and interact with their environment (eg. direct manipulation with virtual objects). In 360° video, the viewer can only control where they look in 360 content that has been prerecorded and not live simulated. (Steinicke 2016, p. Viii; Adams 2016) *Tidal Traces* was created with the intention of being experienced in a Head Mounted Display (HMD) or VR headset.

As we embarked on this project in 2016, we experienced a lack of emphasis on artistic content and exploration in the genre of 360° dance film. Most of the work we came across felt like 360° documentation or compilations of existing stage performances (National Opera & Ballet 2016; Perkovic 2016), rather than choreographies created specifically to be presented as a 360° film. Or, as in the notable Sundance 360° dance film *Through You* (2017) directed by choreographer Lily Baldwin and filmmaker Saschka Unseld, the technical use of cinematographic techniques is prioritized over the artistic content itself. The use of quick edits between scenes and movement phrases

makes the choreographic elements feel secondary to the technical and cinematic use of the 360° medium.

We recognize that 360° video, dance, and film are three separate disciplines which requires different creative approaches and thought processes. Therefore, by bringing the three disciplines together there are limitations from each form and a need for negotiation of methods. In the projects mentioned above, the creative investigations and decision making tend to lean towards either showcasing dance or film, sensationalized through 360° technology. Excited about the creative possibilities in the intersections of these mediums, our intention as we began the research for *Tidal Traces* was to create a piece where dance and film had equal importance in the creative process of serving a 360° medium.

As a contemporary choreographer primarily making work for 'live' events, on- and off stage, I was particularly drawn to explore this new way of viewing dance in 360° film. It offers a bridge between live performance and video, emphasizing the embodied experience for the viewer, often less considered in regular dance film. As a somatic based dance practitioner and choreographer invested in the felt sensation rather than shapes of movement in my work, I was curious how this project and new medium could inform my practice. Throughout my career I've had the opportunity to perform in a couple of dance films (4/4 by Asher O'Gorman, Body Place Memory by Jessica Webb). My experience of these film production processes were similar to those of dancing in traditional stage performances. We would first create the movement material and rehearse it in the dance studio, and then - just like moving the work into a theatre - we would bring the dance to the site where it was to be filmed. However, there are significant differences between a live performance and dancing for a recording. For example, the ability to redo a take in the filming process, which we would often do, obviously does not exist in live performance. The precariousness of 'liveness' is therefore taken out of the equation when creating a dance film. The final result would usually be a compilation of the best shots from the day, taking out any flaws in the performance. The 360° process however called for a different method, blurring elements of a live performance with the recorded moment.

As a filmmaker and media artist working with immersive installation environments and gesture-based interactive technology, I was interested in exploring VR and 360° for dance because VR bridges film and media art by offering the audience opportunity to interact with the content and choose their own experiences in an immersive performance environment. I wanted to offer unique experiences for each audience based on their personal viewing preferences. From past experiences directing and producing dance films, I have developed various processes and techniques

Figure 1. Intertidal mudflats of Boundary Bay Regional Park

to incorporate input from choreographers and dancers while maintaining the creative vision of the film. For dance short *Faux Solo* (2015), I collaborated with choreographer and dancer Ralph Escamillan to create a dance film inspired from different garments. Escamillan developed separate dance phrases in the studio using the different garments, which he then performed for me. Based on the quality of movement in each sequence, I planned how to frame each movement phrase using different camera angles and shot types (wide, medium, close-up, etc). Escamillan further refined his choreography based on my cinematographic decisions leading up to the shoot. He developed different versions of the same movement phrases, adapted for different types of shots. During the shoot, we had a shot list which were all the assigned specific movement phrases he was to perform, and this was strictly followed. I would offer verbal direction while he performed for the camera and I then edited the structure and pace of the film in post-production. Once I had the final edit, created in consultation with the choreographer, I sent it to a sound designer to compose the audio for the film. Unlike the 360° process, in filmmaking, we have relatively established and reliable post-production workflows. Therefore, I can generally assume which software and workflows my post-production collaborators are using and thus not spend too much time worrying about software and video codec compatibility issues.

Based on our individual practices in our respective disciplines, we wanted to produce interdisciplinary work instigated by the following questions through our creative process: How do we compose a 3-5 min theatrical/dance composition for a 360° environment rewarding audiences with different viewing habits? How does the 360° environment complicate the notion of seeing and being seen for both viewer and performance and creators (director and choreographer)?

Creative and Technical Process

Importance of Site

Choosing the site for *Tidal Traces* was an artistic decision influenced from a filmmaker's perspective. Given our limited budget and resources we required a location that would optimize the production value of the piece, and maximize the experience for the viewer in a 360° environment. The intertidal mudflats at Boundary Bay Provincial Park offered a unique location with natural lighting that did not require set design. For a three-hour window throughout the day, the tide was low enough for us to walk several kilometres out into the shallows, giving the perception one was standing in the middle of a vast ocean. [Figure 1] The site also justified the use of the 360° medium, offering a visual experience that most people have not previously encountered. In such a novel setting, the environment itself becomes another subject of exploration for the viewer. Further encouraging different viewing behaviors in which the viewer can choose where and with what they engage. Hovering over the constantly moving waters, offering the viewer perpetual movement their eyes can focus on and explore, besides the dance itself. Being surrounded by shallow moving water far from land also cultivates a sense of tranquility and loneliness. The overall aesthetic of the site and its sense of serenity and solitude was crucial in inspiring the mise-en-scene, choreography, and narrative trajectory of this project. The nature of the site, however, created many practical and technical challenges for the dancers and for the production of the film, which we will discuss in the following sections.

Choreography

From a choreographic perspective, the three dancers; Lexi Vajda, Rianne Svelnis and Zahra Shahab, and I began the process in a fairly traditional way - in the dance studio. However, we approached the initial research knowing that we would film in Boundary Bay and in a 360° space. I was interested in discovering how the VR technology would inform my dance making and looked for differences and meeting points between my choreographic practice and the 360° medium. For example choreographing for the round is uncommon in traditional dance film but a regular occurrence in live performance. In a live setting however, the performer has the ability to track where the viewers looks and adjust the composition accordingly if needed in the moment. Thus knowing you can always offer the audience the experience you want them to have or compose the choreography in response to the audience. In a 360° film situation, this is completely different, you have little or no control over where the viewer will look and when nor the ability to respond to their gaze. We therefore had to consider where the audience might look and choreograph according to those multiple possibilities. I was also curious if the dancers would be able to direct the viewer's gaze and phasing with their activities and movements, making the viewer turn around or follow a specific dancer. For example by crossing through the centre, playing with eye contact or coming in close proximity to the viewer. Our early process consequently included playing tag games and other tasks that activated the circular space. [Figure 2] We took turns to watch from the center and discussed our experiences and viewing choices. During our dance centre residency we also hosted a public Choreography for VR Film Workshop where we explored these ideas further. As the research developed it became apparent that the lack of offstage while filming in 360° and the time gap between the recording of the dancers performance and the viewer watching it, raised questions around control and vulnerability. Who was being seen, and when, and how does it feel not knowing if someone is dancing behind you?

We also explored other interchanging points between the performers and viewers in 360° medium. Compared to traditional film, 360° video offers the possibility to immerse the viewer in the centre of the dance in a different way. We asked ourselves how we could use this immersion to highlight the viewer's experience of his or her own physical body. Thus, the narrative of imposing the viewer as the fourth dancer developed. Another strategy to increase the viewer's experience of their own body was to destabilize our own senses. Based on studies of the 'mirror neurons', scientists have shown that the same part of the brain is active while doing an activity as watching it. (Jola, Ehrenberg and Reynolds 2011). With gaze being the viewer's primary sense, we were curious what would happen with the movement material if the dancers performed with eyes closed, and in turn how that would affect the feeling of watching it. In rehearsal, one dancer would have their eyes closed while being moved around and manipulated by the other dancers for 45 minutes. Then, continuing to keep their eyes closed, they would improvise a solo from the state or felt sensation they were in. The aesthetic quality of

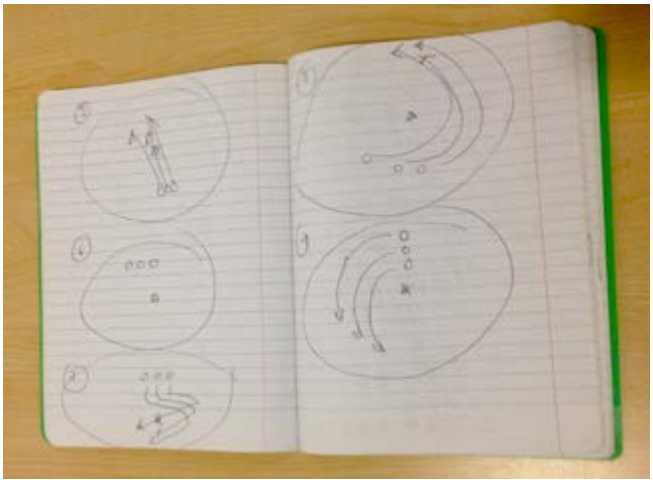

Figure 2. Choreography sketches.

Figure 3. Rianne Svelnis and Zahra Shahab rehearsing on site.

Figure 4. Nancy Lee lying prone in sand during the demo film shoot.

the solo's were often heavy and fluid, with the ground as the clearest reference point of space. The solos were filmed and then developed further into phrases. Our aim was to create a physical counter sensation for the viewer allowing their bodies to become heavy and fluid too.

Moving in water and sand also brings a very specific quality to the dance. Besides the studio research we went out to Boundary Bay to source movement material from the site. The variability of the sand and water levels, as well as wind and temperature strongly affected the type of movements that were possible to perform. For instance, it was hard to jump, turn and accelerate. We still attempted to build a dynamic unison sequence from these findings but leading up to the shoot the result was still too unpredictable. We returned to structured improvisation scores, in which the dancers had more freedom to respond to the changing ground and elements around them. The cold and the wind also affected their muscle tone and ability to execute certain movements. This combined with the short tidal window and the technical set up, made the filming process more similar to that of a live performance than the multiple takes of a traditional film process. [Figure 3]

Film

From a filmmaking perspective, the main difference between directing a 360° dance film and a traditional dance film at a site like Boundary Bay was the inability to provide direction for the dancers while they were performing. There was also a lack of cinematic techniques I could employ (which I usually rely on to support the narrative) and post-production process was much slower and difficult. Furthermore, the site itself also imposed many limitations - we had to work with the changing nature of the ocean (tides, winds and moving sand). It was a challenge to set up the camera, an expensive GoPro Odyssey, 16 GoPro stereoscopic 360° camera rig, in this environment while also keeping the crew out of shot when filming. Due to the vastness of the location, our production crew did not have anywhere to easily hide from the camera's 360° view. While shooting, the production crew retreated 20 metres into the horizon and layed prone in the sand to camouflage into the scene. [Figure 4]. This made it electronically difficult to set up a live feed from the camera with a voice intercom, so instead we had to trust the dancers to perform without much verbal direction. They were also the closest to the camera and had to take on the responsibility of ensuring the safety of the equipment, in case of unpredictable water currents. Therefore the dancers controlled the length of their takes and decided whether they wanted to do retakes or not. These messages were communicated to the rest of the crew through sign language: one arm up signaling re-take, and two arms up - next take. Shooting in 360° video, we realized it was much more of a performers' medium. We had to trust the dancers to judge their own performance, as we were unable to see what they were doing. As a director, I no longer had control over the caption of their performance in front of the camera.

Most video cameras nowadays are small and have underwater housing, however preparing our 360° rig and setting up in the ocean was more challenging. There is no underwater housing for the GoPro Odessey and its Hypercine battery pack. Due to the size and weight of the battery pack, it had to sit under the tripod in the sand, submerged in water. [Figure 5] A Rubbermaid plastic container and a dry bag was used to house the battery pack underneath the tripod to prevent water damage; this was weighed down by a sandbag to prevent the rig from floating.

We used an online tide chart, Windsurfer, to help us determine the height of the tides and the rate in which the tides are moving in or out. We shot the performance while the tide was retreating to reduce stress for the dancers in ensuring the safety of the equipment and execution of the movements. The ideal water depth of for the dancers to

dance in was in between 5-10 cm, which offered enough water for splashing to achieve our aesthetic desires. Besides the short time frame in which the tide was right and the dancers remained warm, the short battery life and limited memory card space (32GB memory cards in each of the 16 GoPros) also restricted the number of takes we could capture.

When shooting a traditional dance film, I rely heavily on framing, lighting, and creative editing techniques to convey the vision and to hide mistakes or cheat production shortcomings. When we shot *Tidal Traces*, the only cinematography choice I had was the height of the camera on the tripod. I shot at two heights, one at approximately 1m from the ground and one at approximately 1.6m from the ground to convey different relationships a viewer could have with the dancers (the latter being more intimate because it's closer to standing height of the dancers). I wanted to minimize number of edits in the film so viewers could feel more grounded in the new virtual environment in hopes of reducing the risk of cybersickness (Rebenitsch & Owen 2016) and also showcase more of the dancers' performance. In traditional dance filmmaking, editing is a tool used to compress time and alter the perspective of choreography to support the cinematography. Dancers are often not performing dance phrases for the camera in its entirety - it is usually performed in smaller sections adapted for the specific shots required. For example, I would often ask a dancer to perform the same phrase three times so I could capture it for a wide shot focusing on the whole body, a medium shot focusing on the torso, and a close-up focusing on their hand movements. For our static 360° camera setup, there was no way to change or manipulate the perspective of the same choreography without revealing a change in the environment. The editing process became a tool to facilitate pacing and narrative progression of the dance film rather than a tool to manipulate the perspective in which the viewer would experience the dance.

The post-production workflow was much slower and cumbersome than traditional film post-production because of the extremely large project file sizes and lack of available softwares to facilitate smooth workflows. The total project size was 16TB. We had our original 8K footages stitched from the Google Jump cloud, 2K proxy footages for editing in Adobe Premiere, 8K footages where the bottom and top zenith holes are patched, and 8K footages where we removed the visible sand bars from the horizons by rotoscoping using the clone brush in After Effects. Most of our post-production process was wrapped up in troubleshooting bugs in video codecs, softwares, finding workarounds and waiting for file transfers and renders. Because our computers would crash frequently during renders, we decided to render every step of our post-production workflow as EXR images, frame by frame, instead of whole Apple ProRes video clips. This way we would not lose our entire

Figure 5. Production team setting up the rig with the blue Rubbermaid battery container.

renders in case it failed - at least we would still have the rendered EXR images up until the failed render. Unlike traditional filmmaking where usually a theatre-ready and web-ready version would suffice, we had to export our film into 30 different codecs to present in different VR platforms, video players and HMDs. Working in 360° also opened up the possibility of having spatialized audio composition to tie in the choreography with the photography of the film.

Audio

The inquiries into interactive immersive 360° environment also assisted in shaping the process of designing the aural component of *Tidal Traces*. I intended to influence the gaze of the viewer through two overlapping-independent sound spheres, which occupied the 3D space: 1) Environmental Sound 2) Action Sound. The former relates to the overall ambience of the film, and the latter to active moments in the choreography, which I wanted to emphasize in order to gain the viewer's attention. The film score and sound design was composed, mixed and spatialized using Facebook's 360 Spatial Workstation (Version 1.3) within the Reaper DAW.

The Environmental Sound resulted in the introductory ambient backdrop. A sound mass of found sounds (field recordings) and digitally created sounds representing the

elemental sounds of the water, wind and land acted as an aural primer for the viewer to habituate to, and be able shift their attention to differing timbres presented throughout. I wanted the viewer to feel as though they were present at the location without it being an exact representation of what it would sound like. This sound sphere gradually transformed by applying micro pitch and filtering effects which kept the sense of temporality of the work.

The Action Sound sphere was influenced by the choreography and scene changes. During the beginning of the work, a violin melody entered in order to produce a sensation in response to the expansiveness of the environment, and to the distance and motion of the dancers. Violin plucks and other percussive sounds acted as moving trajectories, which acted as aural cues for the viewer to follow and shift their gaze. In specific, when two different choreographic scenes were located in opposite angles of the 360° environment concurrently, these sounds emerged towards them in order to guide the movement of the participant. Additionally, water splashes were designed and accompanied the movements of the dancers with changing attenuation based on how close they were to the viewer. The addition of this organic sound constructed a more authentic experience, which coalesced with the musical score.

360° Video Informs Our Choreography and Film Practice

What stands out to us as we reflect upon the process of *Tidal Traces* is the new dynamics between us, as creators, performers and viewers. Choreographing and directing for 360° film for the first time, Michael Klien's (2008) definition of choreography as a way of seeing the world became even more relevant. We knew from the beginning of the project that we wanted to create something different than what we had experienced watching other 360° dance films. We wanted to invite the viewer into the immersive world and give them an experience in which they would feel relaxed and comfortable to take in and be with the dance and the virtual environment simultaneously. However, we didn't expect the shifts in power structure throughout our process to be se prevalent, nor the conversations around vulnerability and control that surfaced during our research.

In my choreographic processes there's often a lot of space for the dancers to interpret tasks in different ways and bring their own artistic ideas to the project, striving to work in a more horizontal power hierarchy than top down choreography. I also like to work with improvisation scores, which choreographs the content by order of events and quality of movements rather than specific steps. The 360° camera technology and Boundary Bay as a site took these aspects of my practice one step further. The unpredictability of the site made the improvisations even more variable despite defining the tasks, leaving the dancers to make more detailed decisions on the spot. During the shoot, the dancers also had full agency and responsibility to interpret the result of their performance for the camera as we were hiding in the sand dunes with the film crew. My role as a choreographer became more about facilitating the process, holding space and communicating, rather than controlling the final outcome. Entering the process with a curiosity of how to choreograph for a 360° dance film, I do feel I learnt a lot and that the progress can be seen in how it was made, not just in the product it became.

Working in the 360° medium has been a synthesis between my practice as a filmmaker and media artist. In filmmaking there are defined roles, industry standards, and widely understood structures and hierarchies in the way people are directed and organized in the process, which media art does not. As a filmmaker, I bring different people with different skill sets together to create the vision. The execution of the vision is done through a series of decisions made based on a familiar film process: Who to cast and who to hire for crew; what narrative or performance; how to convey a message using cinematic techniques; when to shoot and cut, where to shoot; why is this film relevant and why should people see this? We can assume that film technology exists and is stable so we can spend more time focused on the creative execution of the project rather than the technological execution. Since media art has no defined presentation medium, I have to be prepared to problem solve technological issues and spend more time investigating how I am able to execute a idea utilizing different type of technologies, interfaces, and mediums. On *Tidal Traces*' set, my role as a director also became more like a facilitator to offer support for the dancers to perform their best takes without my influence. My role as a director/editor in post-production also took on new meanings - researching and discovering new workflows to workaround technological difficulties. The production process of *Tidal Traces* took on qualities of what I would expect in my media arts practice - managing the uncertainties of performances, technologies and medium.

Ethical Reflections

As VR technology is evolving fast and VR softwares, 360° cameras and HMDs are becoming more accessible to consumers, more attention needs to be devoted to ethical discussions on the widespread use of VR. Frank Steincke states (2016), "The immersive nature of VR raises questions regarding risks and adverse effects that go beyond those aspects in existing media technology such as smartphones or the Internet." We believe that this ethical discussion should not only address the relationship between the VR user and the content producer, it should also address the process in which VR content is produced. Ethi-

cal considerations regarding the production process of our 360° film emerged organically throughout our research.
During our public engagements, demo screenings and workshops, vulnerability was a recurring conversation topic. Vulnerability experienced performing for the 360° camera where the dancers cannot predict where the viewer's gaze is; feeling vulnerable from losing control as creators/director/choreographer; a sense of vulnerability from wearing the HMD and engaging with the content in both a virtual and physical space as a viewer.
From the dancer's perspective, in the precariousness of not knowing what part of their performance is being seen, there was a supportive empathetic relationship developed between the three, separate from the rest of the crew. Checking in emotionally and physically with one another to negotiate takes, wrestling the desire for artistic perfection versus what the bodies could perform in the difficult conditions. Both the physical exposure of the site and the 360° medium added pressure on their performances and expectation to be "on" at all times. Their ability to take care of themselves and each other as the camera was recording became the foundation for the performance of the dance. From our perspectives as director/choreographer, unable to direct and support the dancers the way we are used to also meant navigating new roles and relationships to one another. Giving up control and instilling trust, both emotionally and creatively in order to empower the dancers to make the right decisions for the project became a process in itself. More emphasis was placed on developing relationship qualities, such as warmth, humor and intimacy with each other, which blurred personal and social interactions with the practical and artistic encounters of the work.

From the viewer's perspective, there is no preset 360° cinema language or behavioural codes of conduct when it comes to watching 360° film in a HMD in the same way there is in traditional cinema or during a theatre performance. Therefore, there are more risks for discomfort triggered from the audio-visual content (eg. cybersickness, or invasion of perceived virtual personal space) and risks for injury when a viewer is wearing a HMD and moving around in the physical space. Throughout the process we wanted to consider this both in the composition itself, as well as in the presentation of the work. For example by starting the film with the dancers standing at a far distance gazing away, giving the viewer more space compositionally to get used to the new environment and gradually build the interaction with the performers as they come closer to the 360° camera/viewer. Rather than using an immersive environment to create a sensational experience where the audience may feel shocked, scared, surprised, or uncomfortable, we wanted to find a way to gradually invite the audience into this world and make them apart of the dance. After multiple screenings and public engagements we learnt that the framing of the physical space in which the viewer wears the HMD also contributes to their viewing experience. Creating a 'safe' space sheltered from too much audience traffic and offering different viewing options, such as seated or standing, enhances the comfort of the viewing experience.

It is not uncommon for directors and choreographers to have an authoritarian relationship to their performers and their audiences, dictating both working and viewing protocols. As art practitioners invested in and sensitive to the impact of our work processes and its effects on our collaborators, ourselves and our viewers, we intentionally shaped our creative process so that we could minimize potential for feelings of vulnerability as mentioned above.
Questioning what kind of director/choreographer relationship we wanted to nurture with our performers and what kind of experience we wanted to choreograph for the viewer became central to our process.

Conclusion

In this paper, we discussed the context of our 360° dance film research, the importance of the site in 360° video, and the difference between traditional dance filmmaking and 360° dance filmmaking from choreographic and filmmaking perspectives. We also reflected on how *Tidal Traces* has informed our individual practices, and our ethical considerations while we created this piece. The intertidal mudflat shallows of Boundary Bay served as a site that could optimize production value of the piece and maximize the experience for the viewer, but it caused many practical and technical challenges for production. The main differences choreographing for a 360° dance film versus a traditional dance film is that the viewer's gaze is unpredictable and the filming process is more similar to a live performance than film. As a filmmaker the technological limitations of the bulky camera/battery rig, lack of useable cinematic techniques (can only move the camera up or down on the tripod), slow and unstable post-production workflow also presented a very different process. It became more like a media art practice, with new technology being unreliable and requiring more attention for problem solving and troubleshooting. Similarly, the lack of a 'behind the scenes' and nature of our site create a different production process. Unable to verbally direct our dancers during the shoot, we as director and choreographer had less control of the final outcome than in a traditional dance film. With the dancers having more agency to interpret the result of their performance, the role of the director and choreographer became more facilitative than directive.

Vulnerability experienced by dancers, creators and viewers was a recurring theme during our research process. As art practitioners concerned with ethics, we attempted to address vulnerability by nurturing a collaborative relationship with our performers and created a slow and gradual

360°experience for *Tidal Traces* viewers. As VR technology develops, the technological infrastructures that support the medium such as 360° cameras, VR softwares, computers and HMDs will become faster and more comfortable to use. The technical hindrances we experienced in 360° dance filmmaking will diminish with time. Nevertheless, we believe that our interdisciplinary approach in creating *Tidal Traces* emphasizing nuanced power shifts in the creative process, and ethical considerations that emerged will be relevant in the future of VR discourse.

Acknowledgements

We acknowledge that this project took place on the unceded, traditional and ancestral lands of the Squamish, Tsleil-Waututh, Musqueam, Semiahmoo, Tsawwassen, Stó:lō, and Tsawout peoples. We want to thank our dancers Lexi Vajda, Zahra Shahab, and Rianne Svelnis for their collaboration; The Dance Centre for their studio space and public engagement opportunities throughout our DanceLab Residency; Nicholas Klassen and Robert McLaughlin of The National Film Board of Canada for producing our film; and Olivier Leroux and Vincent McCurly for their technical support.

References

Adams, Eric (2016, July 16) "Most Virtual Reality Is Not Virtual Reality. Here's Why." *Gear Portal*. Retrieved from https://gearpatrol.com/2016/07/18/virtual-reality-vs-360-video/

Escamillan, Ralph. (producer) & Lee, Nancy (director) (2015). *Faux Solo*. [short film] Retrived from https://vimeo.com/187928607.

Ganguly, Shruti & Whitton, Elliot (producers) & Baldwin, Lily and Unseld, Saschka (directors)(2017). *Through You*. [360 film] USA: Fictionless.

Jola, Corinne, Ehrenberg, Shantel, and Reynolds, Dee (2012) *The experience of watching dance: phenomenological-neuroscience duets*. Phenomenology and the Cognitive Sciences, 11 (1). pp. 17-37. https://doi.org/10.1007/s11097-010-9191-x

Klien, Michael, Valk, Steve, and Gormly, Jeffrey. (2008) *Book of recommendations Choreography as an aesthetics of Change*. Limerick, Ireland: Daghdha Dance Company Ltd.

National Film Board of Canada. (2017, Dec 19) *Projects in production and development*. Retrieved from http://onf-nfb.gc.ca/en/produce-with-the-nfb/english-program/projects-in-production-and-development-at-the-nfbs-english-program/

National Opera & Ballet, Netherlands (2016, Aug 26). "NIGHT FALL - First Virtual Reality Ballet in the World (360°)." *YouTube*. Retrieved from www.youtube.com/watch?v=xCp4at6LE0A.

Perkovic, Jana (2016, Mar 7) "Audience takes centre stage in pioneering virtual reality dance film". *The Guardian*. Retrived from https://www.theguardian.com/stage/2016/mar/07/audience-takes-centre-stage-in-pioneering-virtual-reality-dance-film.

Rebenitsch, L., & Owen, C. (2016). Review on cybersickness in applications and visual displays. *Virtual Reality*, *20*(2), 101–125. https://doi.org/10.1007/s10055-016-0285-9

Steinicke, Frank. (2016) *Being Really Virtual*. Cham, Switzerland : Springer, 2016.

Authors Biographies

Nancy Lee is an interdisciplinary media artist, filmmaker, and cultural producer based in Vancouver, Canada. The notion of staging is a constant in Nancy's work and underpins her projects from a more traditional filmmaker into the realms of VR and new media performance and installation. Nancy has performed and presented her work in festivals and conferences around North America, Asia, Europe and Australia. Last summer, Nancy co-produced CURRENT: Feminist Electronic Art Symposium, a multidisciplinary and intersectional music and electronic art symposium working with women and non-binary artists. She is a 2018 YWCA Women of Distinction Nominee for Art, Cultural & Design and is named one of BC's Most Influential Women in STEM.

Emmalena Fredriksson is a dance artist based in Vancouver, Canada since 2013. Born in Sweden, she received her training at Balettakademien in Umeå and at SEAD (Salzburg Experimental Academy of Dance) in Austria. Emmalena holds an MFA degree from Simon Fraser University and has presented choreographic work, performed and taught internationally with Daghdha Dance Company (IE), Canaldanse (FR), Pact Zollverein (DE), and Falmouth University (UK) among others. Continuing her research into choreography as a relational practice in the expanded fields of dance, upcoming work includes collaborations with filmmaker Nancy Lee and lighting designer Kyla Gardiner.

Kiran Bhumber is a media artist, composer, musician and educator based in Vancouver, Canada. She constructs interactive installations and performance systems that allow performers and audiences to engage with themes relating to cultural memory, embodiment and nostalgia. She has performed and presented her works in North America, Asia, Europe and Australia including conferences and festivals. She is currently a Graduate Student Research Assistant at the University of Michigan's Performing Arts Technology Department and a Graduate Fellow at the Centre for World Performance Studies. Kiran holds an MA in Media Arts and a Certificate in World Performance Studies from University of Michigan, Bachelor of Music degree in Secondary Music Education from the University of British Columbia.

The Timbre of Trash: Anthropomorphic Strategies to Resist Technological Obsolescence

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Abstract

Like other manufactured goods, technological audio devices originate from global production systems that are historically exploitative, environmentally unsustainable, and are beholden to the expectations of continuous technological improvement and obsolescence. Unlike musicians who perform on a finite number of cherished instruments that are used for decades, electronic musicians' tools are very often subject to the whims and relentless change associated with technologically-driven economic forces. Computer musicians especially, must consistently adapt to and purchase new software and hardware to avoid losing critical functionality and compatibility. The electronic musician's position in this process opens questions of principle, regarding the ethical defensibility of self-expressive acts relative to the net negative effects caused by their contribution to technological production methods that promote suffering and global destruction.

In response to this dilemma I offer a view toward technological objects that sees these technologies as individual sites within larger systems of activity, and encourages the application of a limited sense of anthropomorphic identification with these devices. Seen in this way, sound technology that was once subject to the whims of constant development, becomes imbued with a personal sense of vitality, making it more difficult to be perceived as a disposable and obsolete.

Keywords

Obsolescence, audio technology, performance, anthropomorphism, materialism, consumption.

Introduction

The position of the digital artist or musician within the context of the consumption of technological commodities offers up some important challenges. To utilize technical devices for expressive ends is also to contribute to the cycle of production and obsolescence involved with global capitalism. A serious consideration of the position of the digital artist within this framework necessitates an ethical examination of the merit of the work produced in relation to the overall waste and exploitation that the connection to technological commodification entails. At first glance, there seems to be little ethical space for the creative technological act. When confronted by the scope of the power structures involved, reactions range from ceding to the futility of the expressive effort and simply cease producing work, or to be overwhelmed by the enormity of the ethical task, and cast aside responsibility as being beyond reach. How does an electronic musician or digital artist acknowledge the results of their expressive efforts in relation to the actions of the beings who sacrificed to create the tools of the trade in a meaningful way? How does one begin to come to terms with the process of technological obsolescence that compels endless consumption and production?

The embrace of an anthropomorphic view of creative technologies can facilitate a more personal connection with the devices used, and can push against the overwhelming aspects of facing up to the totality of late capitalist modes of production. This humanized understanding of technological devices can also be instrumental in providing a view of technology that can meet objects on their own terms while resisting the tendency to consider older objects as inherently obsolete and disposable. The following is an account of how this perspective may be applied to expressive uses of audio technology.

The main aspects of this approach cover two general areas: systemic context and anthropomorphic projection. Systemic context relates to an understanding of the technological that takes into account the socioeconomic functions and environment from which the objects originated and for which they were designed. Anthropomorphic projection describes the conveyance of a personal sense of human connection and responsibility that can result in viewing electronic objects as bearing the traces of the bodies that contributed to their manufacture.

Systemic Context

Electronic devices do not originate from the ether. They are the products of physical, economic and social systems that have history and meaning. To receive a more complete understanding of electronic audio devices, it is important to encourage an extended appreciation of their connection to the structural apparatuses that affect what commodities become produced and absorbed by global capitalism. In other words, to consider audio devices as being the products of and actants within large-scale systems that include capitalism, ecology, political movements, etc. In this sense, objects are intrinsically interlinked within a vast array of mutually co-creative actions and things.

In a setting such as this, the agency of audio technological devices does not discontinue after they have been deemed in the large as non-functional or obsolete for their original purpose. Even though their exchange or use value may become rejected by their manufacturers in favor of a newer product, it does not follow that this value cannot be adapted to other ends.

This applies not only to their operation, but to their meaning as well. As products of a specific moment in time within the mechanism of global capital, they reflect in their physicality the actions and intents of the humans and machines that affected their creation. These aspects include aesthetic design, material choices, operation, advertising, etc. They mirror the view of an intended customer base, a culture for whom the intended audio produced would be relevant, and a hierarchy of values of the product designers as well.

Case Study: The Zoom 505 Pedal

To ground this extended connection of objects to systems, I will focus on a specific piece of equipment that I incorporate into my own practice, the Zoom 505 guitar multieffects processor pedal (figure 1). Produced in 1995 for a mass-consumer market, the 505 was designed to deliver a multitude of simultaneous audio effects that emulated more expensive professional equipment.

Figure 1. The Zoom 505 Compact Guitar multi effects processor, ca. 1995. Photo by author.

I bought my particular unit at a garage sale in 2010. At this time, I was beginning to explore the wider possibilities of low-quality, broken and obsolete audio products in feedback, and the Zoom 505 met at least two of those criteria. When placed within the feedback milieu, I found it able to create an exceptional variety of sounds from delicate, almost tonal repetitions to deep, low frequency growls. The sounds that the 505 emitted in this context were wholly of a different world than those with which it was normatively associated. Although it is now a staple of my live performance arrangement, I would have never considered purchasing the device for its intended purpose. This was largely due to the design qualities and reputation of the company that manufactured it, which was widely associated with inexpensive hand-held recorders and low-end amateur guitar processors. An examination of the Zoom corporation's advertising tactics will provide more context for the company's cultural and economic positioning, as well as the role that audio devices like these play in the wider world of technological audio commodities.

The guitar processing industry, although much smaller than that of tech giants like Apple, is still a formidable economic entity with over $300,000,000 per year in profits (Block, 2011). Akin to other digital technology producers, signal processing companies like Zoom rely on vanity and connection to celebrity to create demand and drive sales. Specifically, Zoom has a history of using celebrity endorsements by popular rock guitarists whom the company believe their audiences wish to emulate. By placing these musicians in advertisements with their products, the persona associated with each musician is presumably extended to the product (figure 2).

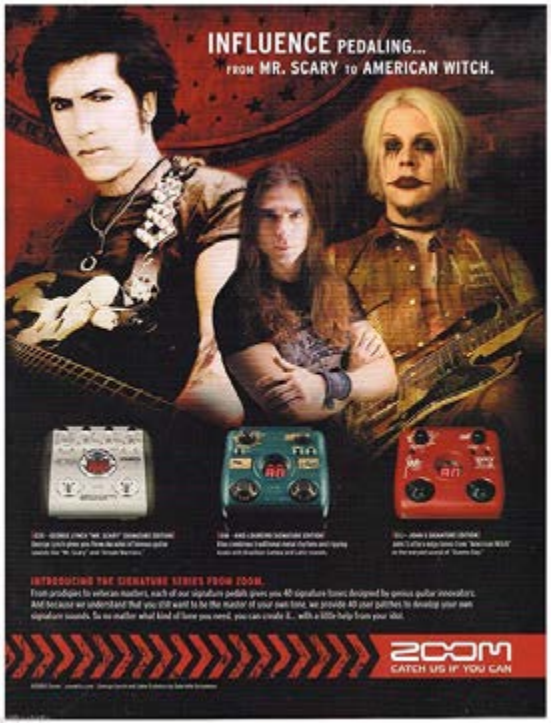

Figure 2: Advertisement for Zoom Signature guitar pedals. Ó2008 Zoom Corporation.

Much of the Zoom corporation's output is solidly aimed at a young amateur market, creating items that were portable and inexpensive but provided the illusion of larger amplifiers. The tagline for the Zoom 505IICG touts the device as being "your first purchase after your guitar (Zoom Corporation, n.d.)." The focus on image and celebrity over audio fidelity is consistent with a youth market, as inexperienced players tend toward prioritizing affordability and may lack the knowledge or interest in reading the technical details of the items purchased. The fact that the same DSP chips were used on many subsequent models speaks to the expectation of these units to be used for a short period of time and then disposed of when the purchaser's interest in music waned. The focus on the image of these products rather than their functionality becomes a necessary mechanism to deliver essentially the same product to new audiences. For products like the Zoom 505 pedal, the necessity for constant influx of capital requires the promotion of a constant consumption of commodities, regardless of necessity or quality. This focus on style over substance conforms to what author Giles Slade describes as 'psychological obsolescence.' Recalling decades of previous authors on the subject, Slade portrays the necessity of obsolescence to capitalist production as one that remains a constant presence in all major markets. To drive home how entangled this process is with modern economic history, he points to a quote from Justus George Frederick, an advertising mogul from the 1920s. Frederick depicted this dominance of obsolescence as a sort of god that required constant sacrifice to allow the very existence of capital:

> "Wear alone ...[is] too slow for the needs of American Industry. And so the high priest of business elected a new god to take its place along with–or even before–the other household gods. Obsolescence was made supreme (Slade,
> 2006)."

Anthropomorphic Projection

The sacrifice required by obsolescence involves not only material commodities, but includes human and nonhuman bodies within the continual rite. It concerns the very human physical manifestations of larger systemic operations that become embedded within the materiality of the audio devices themselves. These include the record left behind by those whose labor and bodies came to produce and assemble the components and cases of the devices. To read audio commodities in this manner is to see them as palimpsests, as collective imprints of the material and human actions that went into their creation. In this way, the obsolete becomes the archival, a record of material and human interaction that emerges as a consequent byproduct of technological manufacture.

Identifying the specific properties and entangled histories involved in the manufacture of technological devices can be a monumentally difficult, if not impossible task to reckon with fully, however. Companies like the Zoom Corporation utilize a method of outsourcing the production and assembly of component parts to exterior companies, whose exchange rates and lax labor laws made manufacturing less costly (Iijima, n.d.). Although this process, known broadly as “electronics manufacturing services," is the dominant method of electronics production, precious little information about the companies serviced, or the environmental and labor conditions involved in the manufacturing process is publicly available. This is likely the product of the desire to keep competitive information and public relations concerns within the domain of trade secrets. In addition, the EMS process often spans numerous subcontractors and factories, making the creation of a complete account its effects an incredibly complex and financially unprofitable exercise to fully and accurately engage with. Aggregate data valuation services do exist, but they tend to be focused on single component manufacturers rather than larger retail producers. Because of this, it became evident that in order to make a positive connection between my own Zoom 505 unit and its potential effect on the wider physical world, it was necessary to open up the device, and personally investigate the provenance of its individual components.

Zoom 505: Identifying Components

Opening the 505 guitar multieffects unit revealed a number of components that warranted investigation. Many, however lacked sufficient markings to enable the proper identification of the manufacturer, or sufficient available information about the manufacturer to determine the circumstance of their making. Of the hundreds of components in the 505 unit, only two IC chips had both identifiable markings and available records sufficient to get a picture of the wider scope of their effects. The first is a semiconductor memory chip that the device uses to store custom presets made by the user. The IC in question is the Winbond W24L257AJ-15 chip (figure 3), made by the Winbond Electronics Corporation in its Memory Product Foundry located in Taichung Taiwan.

Figure 3: Winbond memory chip. Photo by author.

The foundry is situated within a huge manufacturing zone known as the Hsinchu Science Park, where Winbond and many other companies continue production to the present day. The Science Park has a long history of pollution and lax safety standards. A 2005 study found that soil samples taken in the area contained extremely high levels of volatile organic compounds used in electronics component manufacturing (Wang, et al, 2012). Hsinchu Science Park employees also showed decreased levels of pulmonary functions and increased lung abnormalities (Yoshida, 2001), especially in the photolithographic areas that use the toxic cleaning chemicals. These effects extend to local residential areas as well, as many of those living nearby the Hsinchu Science Park show high levels of toxicity in their blood and urine from decades of ground water contamination (Chang, et al, 2001).

The push towards secrecy in terms of environmental problems is common among electronic component manufacturers, but even with this protection, Winbond still earned an independent rating in the 28th percentile for environmental issues in relation to other firms, industry-wide ("CSRhub.com", 2016).

The legacy of the Winbond chip points to the immensity of the scope of information relating to the traces left behind by this particular component. The operation of the memory chip ironically is devoid of a sense of memory in regards to its own production. The little facts we do know point to a continuation of some of the same polluting effects present in the earliest days of the 'Silicon Revolution.' An industry that was touted as being 'clean' in relation to the smokestacks of other modes of manufacturing, instead directed its waste into the ground, where its effects were less detectable until much later (Pellow and Park, 2002).

Connecting Components with Human Lives

A more direct connection between the unit and specific personal effects can be seen in the PCM 3003 analog to digital converter manufactured by the Burr-Brown Corporation (figure 4). This chip handles the conversion of the electrical impulses that enter the unit into digital information and vice versa. This component was produced in Burr-Brown's manufacturing facilities in south Tucson, Arizona. This area has been a concentrated electronics manufacturing center for over 70 years, housing Hughes Air Force Missile Plant No. 44 and other military facilities. The area has contemporaneously been home to a residential population of predominantly Latinx and Native American communities.

Figure 4: Burr-Brown A/D converter chip. Photo by author.

Since the founding of the Hughes plant in the 1940s, the toxic waste from the plants was dumped into unlined industrial pits, which over time leached into the groundwater table, poisoning the city's aquifers with trichloroethylene (TCE) used to clean silicone chips. The contamination affected the local population of over 600,000 residents and contaminated the water in the workplaces of Hughes Aircraft and the Tucson International Airport Authority ("TCE Contamination", n.d.). In 1985, the toxic plume of trichloroethylene from Burr-Brown's factories had been verified as extending far beyond what was previously publicly known. The toxicity spread across an area over five miles long and two miles wide, prompting the EPA to close contaminated wells and declare much of the area a superfund site. At the center of the cloud formation, TCE levels were measured at 20 times the EPA maximum (Ostertag, 1991).

In the eye of the toxic contamination lived Rose Marie Augustine and her family. After being informed of the EPA's findings, she connected the heightened carcinogen levels with elevated rates of cancer and rare disease within her community. Her own family was impacted, with cancer affecting her husband, and her son contracting a rare muscular condition. Both of her family members' conditions she attributed to years of exposure to toxic drinking and bathing water.

After reaching out with community members to local officials for answers they were rebuffed, being called 'hysterical Hispanic housewives' by one official and another telling them that "the people on the south side were obese, lazy, and had poor eating habits, that it was our lifestyle and not the TC [toxic chemicals] in the water that caused our health problems (Cox and Pezzullo, 2009)." The group came to conclude that local officials

knew about the contamination, but did not inform the population about the toxicity problem, for fear the negative publicity would dissuade future businesses from locating in South Tucson.

In response, Augustine organized the Tucsonans for a Clean Environment (TCE) to force local government and manufacturers to make changes to protect the local citizens. By 1991, the group was able to get Burr-Brown to agree to divert its chemical dumping away from the water supply, and Hughes to install a 33-million-dollar air stripper. BurrBrown was sold to Texas Instruments in 2000, but the legacy of semiconductor manufacture endures. After more than 30 years, the group that Augustine founded remains as persistent as the groundwater contamination that still plagues the South Tucson community: in 2017, they engaged in new conflicts over recently discovered 1,4 dioxane contaminants in the water table.

The Technological as Collective Palimpsest

This leaves us with a striking case in which the materiality of a specific component of audio technology had devastating effects on the material and bodies of a wide region. The same TCEs that bound with and changed the Burr-Brown A/D converter to enable its function, also became bound to the bodies of the human beings in the town of South Tucson.

To take these material connections seriously it becomes impossible to separate the physicality of the sonic technological object from its history which, when used by sound producers, includes their own bodies as part of this history. The 'radical permeability' of the technological object as palimpsest, binds audio practitioners up with the ethical and epistemological properties of their tools. The act of engaging with these objects is to bring the discomfiting collected history and effects of its physical components into the mix, in a sort of unequal but collective effort. An action of performance involving the 505 processor then, must also include the actions of the factory workers in South Tucson, and the effects acted upon them by the manufacture of its components, binding their humanity up with the material agency of the PCM 3003.

The perspective of collaborative action brings along with it the associated effects of embedded power relations as well. Can one label a performance seen in this light as collaborative, when the embedded humanity implied by the object cannot signal its consent? Merely considering the prospect can point to a range of reactions from abandoning technological practices on one end, to powerless capitulation on the other. Despite these challenges, I propose that the consideration is worth the risk.

In anthropomorphically considering the technological object as a subjective other, we may begin to approach the task of enfolding the historical subjectivity of the objective world into our own. In allowing the consideration of the electronic components within my own audio devices, I must reckon with the ugly timelines of human-imposed contamination and exploitation that are present within these objects. At the same time, however, I also am obliged to take into account the traces of persons like Rose Marie Augustine, whose actions of resistance are also a component in the shared physical history of the devices at hand. The anthropomorphic projection of the 'fingerprints' of a perceived human agent within the understanding of these crossings can serve to render the task of confronting larger sociopolitical systems more personal and achievable.

Conclusion

The case study outlined above illustrate one example of rather extreme measures taken to create anthropomorphic human connections with the physical nature of audio technology. While it is currently possible for the conscientious creative to inspect and investigate the components in their devices, it is clearly beyond reasonable expectation to prevail upon every audio practitioner to follow suit. The apparent hardship in doing so points out a crucial lack of information concerning the environmental and humanitarian impact that audio technologies have on the ecology and the laborers involved in their production. It seems clear from this examination that such a database or public informational storehouse should exist in order to inform creative practitioners' decisions on the objects they choose to interact with. Until then, a collective attention to the physical imprints and legacy of the devices used by artists can aid in presented the type of concerted effort that may affect the actions of larger system actors to provide such information and cede to the ethical demands of those who purchase their wares. Regardless of the ease in acquiring specific information, the general perception of manufactured objects as having aspects of individual humanity intermingled with their physicality can help to render an ethical value onto them that can transcend notions of use value and obsolescence. In technological audio objects, the projection of anthropomorphic qualities can have direct effects not only on the choice of objects, but of artistic strategy and sound production as well. In my case, the consideration of contextual and projected perspectives led to the embrace of the potential of a shared agency with antiquated and broken audio devices by means of audio feedback. When devices like the Zoom 505 become manifest in the realm of audio feedback, they become a force to be reckoned with - producing often chaotic soundscapes that have as much to do with the contextual aspects imprinted in the objects as they do with my own intentions. The quality of the sounds produced however, have nothing to do with any presumed functional standard or intent of their production. In this context, obsolescence is effectively erased.

Of course, these interactions are not limited to feedback, but the focus on audition and co-creation of new sound is reliant on a sense of openness in relation to the value of audio technical objects. This openness and strategic

anthropomorphism affords a sense of playfulness, that can allow the imprinted human and systemic traces of audio objects to 'speak' in their own voice. Often these voices can produce effects that would never have been attempted with a more traditional utilitarian viewpoint. The results can be exhilarating and surprising. The activity is one that is enabled by and productive of a sense of enchantment toward the devices that belies any sense of obsolescence, providing space for moments of creative serendipity intrinsically intertwined with ethics.

I contend that this type of stock-taking is especially necessary for musical and artistic practitioners. By recognizing the human trace within the technologically obsolete, we can come to terms not only with a sense of value in what would otherwise be considered garbage, but in recognizing the garbage as being in some way partly human. With this carefully limited sense of self-interest, we can hope to develop a capacity for empathy that encompasses physical objects as our own, and in that way impact on our shared sense of ethics and actions. In such a frame of mind, it becomes difficult if not impossible to consider any being, human or non-human, as obsolete. To do so would render oneself without value as well.

References

Block, E. (2011). *NAMM global report*. Ed.s Ken Wilson, Erin Block. Anaheim: North American Music Merchants. p.22.

Chang, S., Tu, W., Yang, W., and Yang, L. (2001). "Environmental and Social Aspects of Taiwanese and U.S. Companies in the Hsinchu Science-Based Industrial Park." *Report to the California Global Corporate Accountability Project* April. p.21.

Cox, R and Pezzullo, P. (2009). *Environmental Communication and the Public Sphere*, Second Edition. Los Angeles, London: Sage Publications. p.277.

CSRhub.com. (2016). Report compiled 8/28/16.

Iijima, M. (n.d.). "Top Message" *ir.zoom.co.jp*. Zoom Corporation. https://ir.zoom.co.jp/message.html. (Accessed September 5, 2017).

Ostertag, B. (1991). "School of Hard Toxics." *Mother Jones*, Jan/Feb. p.179.

Pellow, D and Park, L. (2002). *The Silicon Valley of Dreams: Environmental Injustice, Immigrant Workers, and the High-Tech Global Economy*. New York and London: New York University Press. p.71.

Slade, G. (2006). *Made to Break: Technology and Obsolescence in America*. Harvard University Press. p.60.

"TCE Contamination and Cleanup Curriculum." (n.d.). *US Environmental Protection Agency, EPA, Unified Community Advisory Board for the Tucson International Airport Area Superfund Site*.
http://coep.pharmacy.arizona.edu/tce/index.html. p.6

Wang, C., Chang, C., Tsai, S., & Chiang, H. (2012). "Characteristics of Road Dust from Different Sampling Sites in Northern Taiwan." *Journal of the Air & Waste Management Association*, 55:8. pp.1236-1244.

Yoshida, Fumikazu. (2001). "Sustainability at the Millennium: Globalization, Competitiveness and the Public Trust." In *Proceedings of Ninth International Conference of Greening of Industry Network* Bangkok. January 21-25. p.8.

Zoom Corporation. (n.d.). "Your First Purchase After Your Guitar." N.A. *zoom-na.com*. https://www.zoom-na.com/products/guitar-bass-effects/guitar/zoom-505iicg-guitar-compact-multi-series. (Accessed September 5, 2017).

Political New Media Artworks

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Abstract

In this paper, using a theoretical framework of political interpretation of new media art and interaction, I describe some political new media artworks that I have created and exhibited. Knowing that all relevant enough cultural phenomena admit a political interpretation and, therefore, carry a political stance, new media art's relationship with new technologies carries an extensive phenomenological corpus that intersects many areas of knowledge, rendering sensible the need of awareness of some of these political stances.
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Keywords

Politics, New Media Art, Interaction, Installation.

Introduction

The core phenomena in any problem of politics, indeed in any problem concerning humanity, are phenomena that have at their centre human minds who animate them and who, in turn, are themselves symbolic or cultural processes occurring in the brain; thus, to understand and explain problems of politics one must understand and explain the relevant symbolic and mental processes, which is to understand and explain human actors' forms of consciousness and motivations.
Liah Greenfeld and Eric Malczewski, 2010. {Greenfeld and Malczewski, 2010, #38437}

All cultural phenomena partially codify an understanding of the world, a worldview. This is equivalent to saying that they carry a political stance. New media art involves an extensive phenomenological corpus that intersects many areas of knowledge, rendering necessary the need of awareness of some of these political stances. There is not, and cannot be neither methodology nor praxis ideologically uncontaminated.
Like with other intrinsically interdisciplinary practices which require for both their analysis and practice a multidisciplinary approach (embodied by teams or single persons, what Malina once called "New Leonardos" [2]), new media art does require a high level of fluency in both the arts and technologies. In fact, the *artistic appropriation of scientific and technical knowledge* is the fundamental, defining characteristic of new media art. This appropriation process is not related to a specific knowledge or technology, and allows new media art to omnivorously integrate whatever new inventions and discoveries appear.
However, new media art production is not merely the direct application of new technological knowledge, but instead constitutes a fertile and relevant reflection on the construction of meaning. Because of this, media theories need to move over the fascination of the possibility of technological appropriation. Artistic theory needs to catch up with the practitioners in order to establish a meaningful dialogue, for the theoretical discourse should not be constructed from a fascinated alien perspective.
This appropriation has a direct effect on some of the characteristics of new media art's artistic language. One of the main results is a *systematic explicitation* of elements previously present in art. This explicitation allows these elements to become part of the artistic language, to become words with which artists can build their sentences.
This explicitation can be seen in artworks that are explicitly random (opposed to, for example, oil painting which also is a controlled random process), explicitly interactive (opposed to any artwork that requires the observer to complete it), or explicitly political.
Political new media artworks offer a particular opportunity, for the very act of artistic knowledge appropriation *is* a political one, shifting some of the power inequalities inherent to cognitive capitalism.
If every new media artwork is political (for, as said, knowledge appropriation is a politically subversive act) then explicitly political new media art re-enacts the explicitation process of new media, in a self-reflective manner. Political new media artworks talk as much about the world as they talk about new media art.
The political relationship with technology is a complex one. A complexity that is related to the meta–explicitation and to the inherent oppression that capitalist technological production entails.
In effect, in designing how we interact with technological object, the politicality becomes self-evident: designers and organizations (companies) *sample the world* choosing the problems to be solved and their solutions. It is impossible to think about these decisions without realizing that there is always a political model of reality behind them. In Phoebe Sengers' words: "the proposed 'solution' tends to be understood as technologies that monitor users' behaviour and either influence them to make a correct choice, where the correct choice is generally determined by the technology's designer." [3]

The worldview that any cultural artefact embodies, becomes obvious when one remembers the assumption (both explicit and implicit) of The Market. This is, the assumption of "the applicability of market models and economic exchange". The rendering of capitalism not only as a natural social arrangement, but as the only possible one. This example of ideological models inserted into the cultural practice, this conception of the market as *natural phenomenon* also shows how technological, scientific, and artistic discourses tend to obscure political, cultural and social contexts. [4].
This obscurity as well as this assumption of naturality is frequently present in capitalistic social processes (such as the systematic public funding of universities that generate knowledge operators that work on the private sector).
Explicitly political artworks, then, can provide alternative points-of-view, vantage points from where investigate the construction of alternative narratives.
In the rest of this paper I will present some of my personal political artistic production.
The artistic landscape poses great opportunities and challenges, in art, and therefore in terms of political design, of ideology.

Hong Kong domestic workers

Foreign Helpers (Figure 1) is an interactive installation created within the Architectural Association Visiting School 2015, in Hong Kong.
Directed by Tomas Laurenzo with the collaboration of AAVS students, the installation explores the relationship of Foreign Domestic Helpers with the city of Hong Kong.
With four projectors and four independent audio channels, interactors can use a hand-held screen to explore images of HK (filmed by AAVS students) paired with interviews of foreign helpers who shared their life experiences.

Figure 1 – Foreign Helpers

Given that one's experiencing of a city is composed of different fragments that add-up, the installation deconstructs and rebuilds a vision of Hong Kong created from (or with) the point of view of the participant helpers.

Foreign domestic helpers in Hong Kong are domestic workers employed by Hongkongers, typically families. About three percent of Hong Kong's population, an overwhelming majority are women. The condition of foreign domestic workers is being increasingly scrutinised by human-rights groups and criticised as tantamount to modern slavery. Documented cases of worker abuse, including the successful prosecution of an employer for subjecting Erwiana Sulistyaningsih to grievous bodily harm, assault, criminal intimidation and unpaid wages, are increasing in number. In March 2016, an NGO, Justice Centre, reported its findings that one domestic worker in six in Hong Kong were deemed to have been forced into labour.

Nibia

Background
Nibia Sabalsagaray (1949 – 1974) was a Uruguayan literature teacher and social activist, tortured and killed in captivity at the beginning of the last military dictatorship (1973-1985) in Uruguay.
In 1974, the Military Justice categorized this crime as a suicide by hanging.
Despite Uruguayan Law 15.848 (*Ley de Caducidad*) granting amnesty to military responsible for crimes committed during the dictatorship, in September 2004, Sabalsagaray's sister–Stella–presented to the Uruguayan Justice a letter requesting the change from to suicide to murder, and the identification and punishment of those responsible.
After a complex and long judicial process, in 2010, Miguel Ángel Dalmao y José Chialanza were sentenced to 28 years of prison.

The piece
Nibia is an interactive installation that questions the relationship between society and its recent past, through the recontextualization of a particular image.
The work consists of a room, dark, with black walls, with only one entrance, blinded by double black curtains.
Hanging towards the end of the room, there is a projection of Sabalsagaray (an image very well known in Uruguay), in sepia tonalities. Two meters from the projection, there is a wooden stool with a standard lighter on top of it.
If the interactor decides to take the lighter and light it, the picture in the area corresponding to the position of the lighter burns and disappears. It is, however, impossible to burn it completely: a short time after a zone is burnt, the image is reconstructed.
Technical details
The detection and tracking of the flame is done with an infrared camera (either a Wii Remote controller or a PS Eye camera), with a simple blob detection algorithm.

Figure 2 - Nibia

The burning simulation is done by manipulating the pixel values (using an algorithm similar to the burning effect usually present on image manipulation software), following an upward motion constructed by randomly mixing several paths recorded using a drawing tablet.

Two Systems

Two Systems is an interactive installation reflecting on control and its representation.
The installation consists of a tabletop display showing a high-resolution stop motion animation with interactive sound.
The animation consists of a thirteen-frame laser-cut hand drawn animation of a fire. These photos, once photographed, where gradually burned, generating new layers of stop motion animation. This burning created orthogonal axis of animation. There are thirteen different sets of burned pieces, giving a total of 169 possible images that are animated following arbitrary paths in these two axes (time - burning).
The animation path is controlled by the spectator with two knobs. The knobs, directly control the sound the installation creates. This sound is created by algorithmically combining two different recordings of the Umbrella Revolution (Hong Kong's student-led pro-democracy demonstrations in 2014).

Figure 3 – Two Systems

Although the two controls have a direct impact in the sound that is being reproduced, the causal relation between the spectator's interaction and the sound changes permanently, turning impossible to learn how to control the sound.

The installation reflects on control, information, and representation.
Two Systems participated on The Age of Experience. A collective show at the School of Creative Media of City University of Hong Kong, curated by Dr. Harald Kraemer.
This work originated at the NYU's 2014 ITP Summer Camp in New York.

5500

> *"The blue waters of the Mediterranean have become a bloodbath for desperate immigrants seeking refuge in the European Union."* — The Migrants' Files

In the period between June 2014 and June 2015, at least 5,500 immigrants died trying to reach Europe from Africa while crossing the Mediterranean Sea.
5500 is both a musical performance and a data visualization performance. It consists of a performance of Ludwig van Beethoven's Piano Sonata No. 8 in C minor, Op. 13, commonly known as Sonata Pathétique, where the pianist's execution is disrupted using computer–controlled electrodes

Figure 4 - 5500

which stimulate the nerves in their arms causing involuntary contractions of his or her muscles, and affecting the final musical result.

In this work, the calendar dates on which these deaths occurred are mapped onto the time sequence of the performance, in such a manner that the calendar year is spread over the course of the sonata. This means that, for the average performance length of Sonata Patéthique being around eighteen minutes, the nine-minute mark represents six months into the year.
The data of the immigration incidents was obtained from The Migrants' Files, a project launched in 2013 by a group of European journalists and researchers.
5500's representation of the deaths of the migrants unfolds in two orthogonal axes: a digital muscle memory implant that transforms the body itself into an apparatus for representing and remembering socio-political processes; and the resulting music, a classical piece of European Culture directly affected by its own representation.
The performance was premièred on the 1st of July, at the School of Arts of the University of the Republic, in Montevideo, Uruguay, with pianist Bruno Benedetto.

Technical details

The performance involves a standard piano, a computer, a projector, and the EMS device.
The EMS device consists of a laser–cut black acrylic box, from which the electrodes are connected. Inside the box, there is a medically compliant signal generator. We use an Arduino UNO and four relays to control whether the signal from the pulse generator reaches the electrodes. The communication between the box and the controlling computer is via Bluetooth.
The electrodes are situated on top of the ulnar nerve in both arms of the performer. This way, when electricity is conveyed, the hands of the performer twitch, preventing the normal execution of the piece. We use a frequency of approximately 25Hz and a pulse width of approximately 290 μs; however, these values are calibrated before the performance as they depend on the exact location of the electrodes and on the performer's sensibility.
The system is programmed in Java/Processing.

Epilogue

This paper presented several explicitly political new media artworks. These personal explorations aim at creating a political artistic discourse from the technological appropriation that new media art entails.
The pieces try to escape from the formal assumptions that the involved technological artefacts bring, while simultaneously escaping the *intended use* of these technologies.
These artworks propose an appropriation of the *poetic dimension* of these technologies. New media art proposes this technological dimension as part of the sensible, it inscribes the reason, purpose and technicality of the tools into the art practice, "fractalizing" the technology and its products: each change creates new tools and new possible changes, it systematizes serendipity.
It is natural that in a society of knowledge an art language is created from within this knowledge; therefore, it is in the differences of the relation with knowledge where a big part of the need for a peripheral, conceptualist, new media art, resides.
In fact, what is needed is a meta-appropriation: the socio-political appropriation of the context that would allow for original new media art, that is, *the appropriation of the processes of construction of knowledge.*

Acknowledgements

The work described in this paper was partially supported by a grant from the Research Grants Council of the Hong Kong Special Administrative Region, China [Project No. CityU 11674416]

References

[1] Greenfeld, L. and Malczewski, E. 2010 Politics as a Cultural Phenomenon. In Handbook of Politics, Springer.
[2] Malina, R. F. 2005 Foreword. In At a distance: Precursors to art and activism on the Internet, A. Chandler and N. Neumark,Eds The MIT Press.
[3] Sengers, P. 2010. The Ideology of Modernism in HCI. Critical Dialogue: Interaction, Experience and Cultural Theory Workshop, CHI'10.
[4] Boehner, K., Vertesi, J., Sengers, P., and Dourish, P. 2007. How HCI interprets the probes. Proceedings of the SIGCHI conference on Human factors in computing systems, 1077-1086.

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Tomas Laurenzo, PhD is an artist, computer scientist, and academic working with both physical and digital media exploring the artistic construction of meaning and its relation with power and politics. Laurenzo's production spans across different practices, including installation, interactive art, music, live cinema, and digital lutherie. His artworks and performances have been shown globally. He is Assistant Professor at the School of Creative Media of the City University of Hong Kong. He has published mainly in the areas of New Media Art, and HCI.

Cyber attractions of WagonNet: modes of activist engagement for reclaiming the public space.

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Abstract

This paper investigates modes of activist engagement on a performance in public space. The discussion anchors on the case study analysis of the project WagonNet (Brazil, 2011-2014). The artistic practice combines a processual and relational aesthetic to presuppose the other in the city context. It imbricates human and non-human agents in a wagon converted into a "cyber machine", which works as a mobile digital station connecting the material and the virtual world and audiences. The performance evidences some dialogic aspects of culture, such as the relations between local and global, archaic and modern, backwardness and progress. The authors focus on this artistic experience to discuss two main topics: how to potentialize the urban environment as a place of encounters, and how the exploration of the city suburbs can be turned into an activist act.

Keywords

performance, public space, cyborg, cyberspace, mobile media, locative media, technological misuse, activism, relational aesthetics, participatory cartography.

Introduction

Cybernetic mediation by ubiquitous and mobile media became a major deal to contemporary life. These communication systems are reshaping the way people interact among them, and with the public space. A broad network infrastructure allows all kinds of data analyze, also in real-time, and promotes fast connectivity between individuals and institutions. With a variety of urban processes being optimized by technological innovation, the smart city promises us more efficiency, sustainability, openness, transparency, and new modes of participation in government decisions (Kitchin, 2014). The architectural environment of metropolitan areas crossed by the digital communication flows is challenging urbanism, the comprehension of urban public life, and the historical idea of the city. On this context, vindication for public digital literacy and access became a major demand as "at stake is not only setting the terms for public access to the vast databases of open source information but constructing the sustaining architecture to do so" (Tuters, 2004, p.5). Citizenship in these "augmented public spaces", in which the built environment coexists with layers of information and media content (Manovich, 2006; Allen, 2008), should so presuppose not only easy access to the Internet. It should include the very means of enabling people to create, use and exchange a diversity of local and global content.

In this scenario, artistic practices play a vital role in laying the ground for both: technological innovation and citizenship. Providing opportunities to build particular forms of interactions between people, place and digital systems, artists working with computers and the Internet make direct and indirect contributions to the development and implementation of cutting-edge tools in the digital cities. By one hand their creative technological innovations reinsure a fundamental guideline for social acting in contemporary society, associating aesthetic experimental production and scientific reflection. On the other hand, as vital social agents, these artists can even take off the ideological wrapper of a medium and reveal twisted values underneath their modus operandi. When it happens, a third essential ingredient – for those who value Democracy and diversity - is added to this guideline: critical thinking.

The first artists working with locative media, for instance, often pointed out the risks of a society of control with invasive surveillance tools (Tuters & Varnelis, 2006). More then ten years later, the movement keeps its propose of using location data and spatial context to create a new meaning to this awareness of the place, by social and participatory interactions with socio-political activism (Aceti, 2016; Southern, 2016). Artistic practices that have the city as a locus so usually operates on such attempt to approximate art and live through diverse modes of engagement within the public space, constructing a common (Negri, 2016) ground for the occupation of the cities and the city life itself.

As Ippolito (2012) argues, innovation itself is not art:

> what sets art apart from other technological endeavors is not the innovative use of technology, but a creative misuse of it. Today's technological innovation may be tomorrow's cliché, but the creative misuse of technology still feels fresh even if the medium might be stale (Ippolito, 2012, p.487).

The creative misuse of technology can be seen as a form of resistance, as it might evoke different and creative modes of interaction and engagement, instigating people to re-imagine their relations with place (Farman, 2014) and with digital machines. While the new generation of technological systems has reconfigured the geographic, cultural and perceptual space, artistic practices with locative and mobile media come to evidence specific issues on a political basis. Spatially located and contextualized works of art look for composing particular resonances related to geography, cartography, and sometimes politics. They integrate connotative and denotative meanings of the urban life and address questions that embrace demographic changes, borders, gentrification issues, preservation concerns (Hight, 2006). Some geolocated and site-specific projects invite people then to rediscover and experiment the territory by navigating and getting in touch with places never visited, or visited but not properly experienced, usually due to the rush that characterizes everyday life in postmodern cities. The artistic practice with locative media creates new connections between digital culture and physical places by generating particular narratives of space that proposes a different manner of seeing, act and claim the city.

Regarding these issues, this paper takes as a case study the project WagonNet cyberAtractions[1], a collaborative proposition using mobile and locative media as means for a participatory cartographic practice (Sotelo-Castro, 2010). The artistic project approaches the city as a sensible territory (Rauscher, 2013) and acts valorizing the agency of artist's self-mapping as it travels through the cities during four consecutive days. In a relational aesthetics (Bourriaud et al., 2002) the premise of the project is to promote encounters with the others of the smart city above described. The unusual "cyber machine" registers local culture and share it globally on cyberspace. The title of the artistic proposition uses neologisms associating animal traction vehicles and the Internet, implying a possible dialogue and imbrication between humans, animals, and machines – and bringing up the essence of ambiguities that goes through all the artwork. In a misuse of digital and mobile technology, it links the local to the global in an inclusive mobilization that celebrates a common.

WagonNet – a cyber machine

The project WagonNet cyberAttractions[2], or *ciberAtrações CharreteNet* as it is called in Portuguese , started in 2011 in Uberlândia as an activist urban art project, with the aim to strengthen social bonds between cultural initiatives (including independent media), and peripheral communities, empowering both. Most of these communities are of low-income people and in areas of social risk. With a prize of Funarte, in 2014 the performance traveled across the peripheries of Belo Horizonte's metropolitan area, and after that on the Federal District, around Brasília.

The artwork concept got inspiration on the "Cyborg Manifesto", written by Donna Haraway. The project plays with the transgressed borders between the technological machine, the human and the animal by giving a wagon, transmuted into a mobile station, a central role in the performance. The WagonNet points to a pleasurably coupling rather than on a barrier between people and other living and non-living beings. On her writings, Haraway (2000) argues about the human animality to reduce a possible line separating both entities, and mention the late twenty-century machines to highlights how they have made ambiguous the distinction between natural and artificial, mind and body, self-developing and externally designed. Following her approach, such differences commonly applied to differentiate organisms and machines seem to be blurred. "Our machines are disturbingly lively, and we ourselves frighteningly inert" (Haraway, 2000, p.294).

Thinking about who conducts the wagoNet, the triad, coachman, horse, and cabin, seems imbricated as an extension of the same symbiotic body. In the same pattern, hybridism comes to mind when looking at the relations established between the invited artists and the mobile devices they carry along. The "Cyborg Manifesto" claims that there is no fundamental and ontological separation in the formal knowledge of machine and organism, of technical and organic. Recalling to an imagined organic body, Haraway (2000) draws a myth of a cyborg society, in which people are not afraid of their joint with animals and machines. Identities have artificial components and contradictory standpoints, what this complex hybridization with other communication devices and species come to evidence that. Informed by such post-modernist feminist-materialistic approach, the project WagonNet sees on the imbrication and confusion between human, animal and machines, a potential source. The performance embraces Haraway's myth of resistance to pursuing the task of:

> reconstructing the boundaries of daily life, in partial connection with others, in communication with all of our parts (...) Cyborg imagery can suggest a way out of the maze of dualisms in which we have explained our bodies and our tools to ourselves (...) It means both building and destroying machines, identities, categories, relationships, space stories (Haraway, 2000, p.316).

The performance centers on such universe of thought by transforming a traditional cargo structure into a cyborg machine. Technological and ludic, it promotes encounters in public space. Encounters with the horse and the invited artists. Encounter with the digital media coupled on this

[1] Http://charrete.net

[2] The project was conceived by Gastão Frota and executed together with many artistic collectives, such as MUDI – Uberlândia Cultural Movement, Pássaro Preto and Fora-do-Eixo (Mídia Ninja).

cyborg machine. Encounters with nostalgic memories of an ancient city and modes of sociability, as well as with forgotten parts of the city, its residents, and cultures that are looked down on by mainstream visibility. The wagon transmuted into a mobile digital station takes a performative navigation through the urban space. Where it goes, it means an opportunity for a cultural and artistic experience and production, which have the collaboration of several fundamental actors. The involved agents have a crucial role in the political-cultural efficacy of the artwork. Such re-appropriation of an animal traction vehicle comes to highlight the dualism of categories such as archaic-modern; overpass-progress; local-global; individual-collective; public-private; memory-forgetting; work-leisure; objectivity-subjectivity.

Brazilian Cultural and Technological Context

Uberlândia, like other cities in Brazil, has been the object of individual initiatives by artists and activist groups to emphasize the weak or even non-existent cultural policy of the municipality. The MUDI collective, for instance, arose from the need of urgent resistance of civil society. They gathered artists and activist when the city councilmen tried to approve a law that requires a license to carry out any events in the street, demanding prior authorizations and even payments. The MUDI movement, articulated through e-mails and face-to-face meetings, with open participation and without moderation, came as a response to this government attempt to infringe on the rights of street performers and on free and spontaneous uses of public space by citizens.

The WagonNet cyberAttractions, as an activist art, inserts in such desire to reflect upon the Brazilian cultural institutional program[3]. The project brings Bauman's (2009, p.35) ideas about the city as a place in which the human experience takes form, is accumulated, and shared; a place in which we elaborate, assimilate and negotiate the cities' meaning. The performance operates on the principle of digital free culture, using the ideas of participatory art and multilocal actions. In this propositional context, the project devotes to an investigation characterized by collaborative thinking, mediation, open source softwares and technical hybridism.

These are crucial assemblages to the collaborative formation that underpins this project, which in the broader context is instigated by the consolidation of municipal councils and telluric engagements in the implementation of the National Plan of Culture[4]. In its struggle to empower new channels of dialogue between workers and local culture lovers, via social networks, WagonNet cyberAttractions promotes a confrontation between "globalized powers and the tenacious local senses" (Bauman, 2009, p.35) - in two-way relationships, based on networking with independent artists, cultural promoters and activists. It is a processual artistic project based on propositions.

Mobile Infrastructure

The "cyborg machine" of WagonNet project is made of a wagon equipped with a mobile phone enabled to connect to 3G networks and send GPS data, a portable computer, cameras HD and a megaphone. Processual, the performance started by encountering a coachman - that wanted to change the business from cargo to entertainment -, and getting a wagon, called "charrete" in Portuguese, that is itself made from recycled materials.

The artwork involves the process of decorating the wagon with objects traded during the journey, in a solidarity economy mode. A flag fixed to the back of the wagon flies like a dancing paraglide to the rhythm of the horse's walk. When it stops, the barter-happenings take place, and people are invited to trade all kinds of stuff, actions, and objects, provisions, and even rules. The incorporation of several objects results in a colorful and festive ensemble.

Figure 1: The colorful and festive ensemble of the wagon.

The WagonNet gets empowered by easy, accessible, "cost-free", open source tools. Precarious wifi connection gives support to the given structure. Characterized by the slow pace of its displacements and with a popular appeal, these "cyber station" can instigate improvisations, host, capture and transmit contents in real time. "Creative, ironic and revolutionary", as described by Rauscher (2013, p.21), it connects the local and the global, the virtual and the physical domains.

The performance has its course and existence from a set of collaborations and relationships built on directly and through social media environments. Open calls on mailing

[3] In 2013, the X Funarte Prize, from Brazilian government, selected the project together with other initiatives that had a marked activist character.

[4] ttp://pnc.cultura.gov.br/

lists of activist groups in the city gathered a group of collaborators and entities to the project. This process shapes the dynamic, setting up the stop points that together with the limitations of the vehicle, defines the routes for the navigation. Moved by Barter-Happenings**,** each tour starts with the choice of the horse and coachman, following ecological criteria of animal care, and the social representativeness of the coachman among the local communities. The definition of the itinerary is an online and direct networking negotiation. It depends on the response of those who, identifying with the political aspects of the project, agree to host the WagonNet at their offices, houses, communities centers, etc.

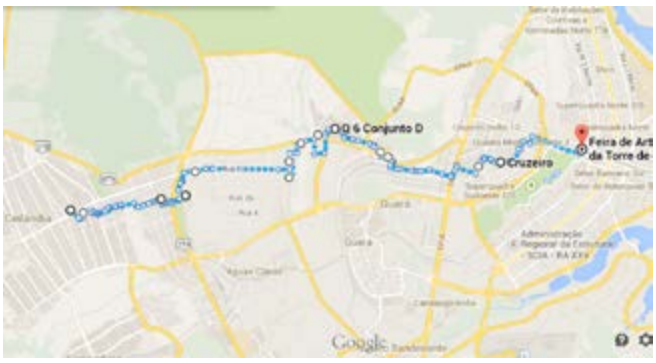

Figure 2: One of the routes taken by the WagonNet.

The journey is sustained by the barter-happenings, in which people can trade all kinds of stuff, actions, and objects, provisions and rules. Hosting the horse, the wagon and the artists, an establishment may get advertising. Giving their art product, they can choose a cd, a painting or a book from other barters. Dancing, singing, reciting, they may get even another live performance from the guest artists. Local artists could, for instance, get HD recordings of their performances in exchange for allowing the live stream on the Internet of their participation.

In a "Do-It-Yourself" style and based on networking with independent artists and cultural promoters (such as Fora-do-Eixo and Estilingue), the wagonNet represents itself a cyber attraction for both: the bystanders on the streets, and an online audience. Each event means an opportunity for planned and no-planned encounters. Some people who came across got a ride on the "cyber machine", some sang, others played instruments, did political claiming, told old stories, read poems, drew the scene, danced. All sort of expressions went online in real-time on Social Media. This material, generated while the wagon is on the move or parked, travel through 3G networks to reach an online audience. The artwork extends site-specific notions with a locative practice that interrelates the virtual and the material spheres by sharing exploratory experiences of the urban space through posts on Youtube, Qik, TwitCasting, Twitter and Facebook.

Artists and those who collaborated with the project shared the operations of recording images and sounds using portable, professional and non-professional equipment. Following the principle of free digital culture and participative art, the project experimented with aspects such as double-cameras and rotating rules of interviewed/ interviewer, photographer/ photographed. The community residents themselves also captured the images, some of them becoming quickly familiar with all the process. They organize themselves for carrying out cultural presentations (dance, percussion, hip-hop music), as they want to be filmed. They also make themselves available to photograph and film, to reproduce and transmit the content to the cyberspace. They want to do-it-themselves.

Discussion

The urban as a place of encounters

WagonNet cyberAttractions proposes to minimize the condition of unfamiliarity and isolation, that some Brazilian artists and citizens have in relation to the experience of the diversity of local and cultural agents. The project foresaw in its conception the contact and visit to cultural institutions, and entities on neighborhoods neglected by cultural policies. Many times the WagonNet got on unplanned routes that would lead to aleatory encounters, mobilizing all sort of citizens and emotions. On its exploration of the urban space, the mobile station crossed, mixed, infiltrated and blurred the borders of the compartmentalized city.

The trip of the "cyber machine" into the peripheral districts represented an encounter with the opportunity of access to the Internet and digital media. That was the first opportunity for many individuals and populations. During the trips, the spaces mapped by these visits turned into a producer of cyber attractions. The project was moved by such desire of empowering the Art & Culture sector of Brazilian cities. In this sense, the horse-wagon worked as an affirmative symbol and agglutinating agent among those interested in the democratization of the artistic and cultural circuit.

As Rancière argues (2013), the sharing of the sensible involves the distribution of spaces, times and forms of activity, something in common that leads to participation. The ability or inability of various individuals to participate in this distribution by their own desires and singularities is what ties aesthetics to politics. This politics is inherent in the logic of representation and includes sensorial appeals behind the political redistribution of shared experience. "The distribution of the sensible reveals who can have a share in what is common to the community based on what they do and on the time and space in which this activity is performed" (Rancière, 2013, p.12). The politics appear as a form of experience, "revolves around what is seen and what can be said about it, around who has the ability to see

and the talent to speak, around the properties of spaces and the possibilities of time" (Rancière, 2013, p.13). The artistic practice proposed by the project is a transgressive appearance of unauthorized speakers on the public stage.

As Art and life approximates, the ciberAtractions centers on the invention of relations between subjects, configuring a situation to recreate models of sociality in open public environments. (Bourriaud et al., 2002). The creative process gets on the relational and processual aspects as principles. The artwork takes form from intersubjective relations established between a place, its residents, and the invited artists. Intersubjectivity became then the main element that give shape to the artistic action, that is improvised and performative rather than planned and pre-scripted. The complicity of sharing a given place and moment, the idea of building a shared memory between those involved in the encounter strength a relationship that is artistic, affective, and also politically effective.

Artistic projects like this one open space for the participants to establish differentiated relationships with the practice, and to assume, at least in part, responsibility for the mutations in course. Processual, the creative act here depends not only on interaction, but on the exchange of experiences. The dialogue and also the ephemerality appear as major features that characterize this public urban art production. Bourriaud et al. (2002) considers the encounters as the central aspect of a relational aesthetics in art, which valorizes the human interactions and its social context, rather than relegate art to a private and autonomous symbolic space. When such encounter, unexpected or casual, happens in the public space, it opens room to an all-embracing dialogue.

Figure 3: The performative casual encounters in public space.

The invention of a proposition welcomes and connects different cultural productions opening room to creativeness in diverse experimental practices. The project has its existence affirmed through relationships and collaboration that can be extended and spread out. The drift appears as desire, prevailing the possibility of meetings and bases of welcome (Rauscher, 2013). During four consecutive days, the local community gets mobilized and attracted by the technology, but also by the artists's interventions and the wagon itself. The "cyber machine" attracted, for instance, a great number of children. In the time they spent together and immersed in that artistic experience, the digital station showed and registered part of that diverse local culture in a non-hierarchic mode. The artistic practices affirm itself as forms of art that inscribe a sense of community.

"Performances are 'involved in politics', whatever may otherwise be the guiding intentions, artists' social modes of integration, or the manner in which artistic forms reflect social structures or movements" (Rancière, 2013, p.13). As a political aesthetics, it destroys the hierarchies of representation and creates a community formed only by the random circulation of the artwork.

In WagonNet, the representation of the cultural diversity of peripheral areas results from the collaboration and interaction between local people and artist, between seeing, doing, and speaking in these improvised rites. The WagonNet, by offering, even temporarily, the experience of cohabiting the square, the streets, and the network, allows us to think about the public spaces and questioning the origin of the speeches. The face-to-face meetings are decisive in the project proposal. The interactive aspects of the performance are absolutely dependent on the participation that precedes it. Hence, this make-and-share of the sensitive happen through the context of encounters between theory and practice, digital inclusion and empowerment of local networks, animal and machine (Gastão & Rauscher, 2013).

The cyber wagon ride as an activist act of reclaiming the public space

Considering the effects of the "informatics revolution" of digital media, as Bauman (2003) observes, some analysts have radically proclaimed the prognosis of an imminent disappearance of the "city as we know it", or even its replacement for a new spatial form of human cohabitation. The metropolitan regions worldwide do have been experiencing an accelerating pace of transformations. The "postmetropolis", as Soja (2000) defines it in opposition to the modern metropolis consolidated in the middle decades of the twentieth century, can take specific forms in specific places. With different degrees of change all over the world, such urban restructuring results in profound changes that in some cases turned almost unrecognizable what existed or was familiar few years ago (Bauman, 2003, p.4).

That is the case, for instance, of the polemics about vehicles of animal traction in urban areas. Though some people may think they are obsolete, the fact is that horse-wagons are still circulating in many Brazilian cities. In Belo Horizonte, the fourth biggest city in Brazil, for instance, there are at least 2.500 of them registered at city

council. In most cases, coachmen utilize these animals to transport objects and rubble, as a source of income. Those who have the wagon as a mean of survival are representatives of a model of the informal economy, whose confidence relies on their own wits and individual initiatives and even in a passion for autonomy – could an artist identify with that?

In the name of progress, many debates have been carried out by politicians trying to get rid of animal-drawn vehicles. Under the discourse of protecting the horses from a supposed slavery condition, there are also strong interests of recycling industries on getting the monopoly of trash management, no manner how many families would get miserable by that. Behind the idea that cities are not healthy for horses, one may ask whether this environment is for humans health, including in its mental and psychological aspects. Does the majority of people really want to live apart from non-human beings? The presence of wagons in the streets of (post) modern Brazilian cities represents this kind of tension.

The WagonNet underscores such contradictory logic in Brazilian contemporary urban spaces, as the wandering of coachmen contrasts significantly with the imperatives of post-modern urban traffics. In this context, wagons represent both: a nostalgic memory of that same territory - now generalized in a mercantile space, and a reminder of the backwardness, poverty, and slowness that cohabit with the city taken by modern automobile logic. In tis context, the paradoxical WagonNet became a plastic and critical object (Frota & Rauscher, 2013).

Whether the wagon is determinant to shape the critical meaning of the artwork, its navigation through the urban space also has an activist vein of reclaiming that territory to who has its circulation restricted and their existence rejected. It comes calmly but not unnoticed, as it links that moments experimented in the outskirts of the city to a broad audience following online. Many who came across the WagonNet also took that moment to protest and make visible what in general remains invisible, and by doing so they brought to an online audience a self-mapping of urban areas that are generally neglected by broadcasting media. The empowering potential of the proposed artistic practice seems to reside on a self-positioning enabling agency; or as Sotelo-Castro (2010) defines it, on "the act of sharing the spatial autobiographical narratives that result out of the participation process that the participants may be enabled to position and map the self" (p.593).

As De Certeau (1984) points out, by navigating the city, the ordinary men not only experience location but also create an infinity of stories that lives under the visibility. During the tours with the WagonNet, participants became the protagonists of displacements that give visibility to stories other than those of violence and stupidity, what usually characterize the space of poor communities on media.

Analyzing the project, Nardin & Boel (2013) observes that when the WagonNet visits and registers images and sounds taking place in the city, it is building a network on the urban cartesian map. The project does it by connecting the peripheral points trough unexpected routes, which function as modifiers of the use of space and consequently become shared paths. As Bourriaud et al. (2002) observes, such kind of artistic-relational practices creates modest connections, opening some obstructed passages, putting in contact levels of reality set apart. The digital station, for instance, streamed the moment in which a community was evicted from an irregular urban area. Being expelled by police forces, they used the opportunity to protest against the Major, the policy of the municipality, and to the difficulties of access to cultural, social, health and leisure spaces, and even water.

Under this *modus operanti,* the project can be characterized as a biopotent aesthetic resistance, as Rena, Berquót & Chagas (2014) articulates the concept in the reversal of the term biopolitics. While the latter regards the power *over* life, the former signalizes to the power of life. In WagonNet, the biopotent resistence is against the rush for gentrification and hygienist politics under neoliberal urbanism.

Conclusion

As we have discussed, the WagonNet performances created spaces of flow for the distribution of sensory experiences, using the own globalization resources and augmented space of postmodern cities to put in evidence local meanings and discourses. The cognitive, artistic and cultural map traced by the performance gave visibility to a peripheral city, through the materialism of encounters with local agents.

One mode of activism engagement then concerns the valorization of a diversity of human life styles, the affirmative inclusion of the forgotten or silenced voices in the political arena. That is the case of coachman families surviving upon the garbage of consumer society, and other groups excluded from shared visibility and voice on media and cyberspace by globalization process of postmodern cities.

The other activism mode includes an even bigger challenge that is related to how western civilization deals with nature and its diversity of species. In opposition to the utilitarian view, by which all things on earth exists to serve man, WagonNet cyborg character points out to the possibility of a more symbiotic relation between non-human animals, machines and humans. A symbiotic hybridism instead a parasitic mode of relation upon nature. As we lodge our body into the gallop of these walks, our humanity copulates with the animal, activating rhythmic memories that echo the frictions from sex to laughter – crossed by an infinite synergy of common affections that gives weigh to being, thought to body and life experience to technology – a sense of frontier of the ecological

challenges.

The modes of activism engagement that characterize WagonNet cyber attractions should be understood so as an attempt to valorize the diversity of life, in a broad sense, against the standards of the "postmetropolis" and the immaterial values of cognitive capitalism.

References

Aceti, L. (2016). Meanderings and Reflections on Locative Art. *Leonardo Electronic Almanac*, 21(1), 10-13.

Allen, P. (2008). "Framing, locality and the body in augmented public space". In Aurigi, A. & De Cindio, F. (eds.) *Augmented urban spaces: articulating the physical and electronic city.* Hampshire: Ashgate Publishing Ltd., 27-39.

Bauman, Z. (2009). *Confiança e medo na cidade*. Rio de Janeiro: Zahar.

Bauman, Z. (2003). *City of fears, city of hopes*. London: Goldsmith's College,.

Bourriaud, N., Pleasance, S.; Woods, F. & Copeland, M. (2002) *Relational aesthetics*. Dijon: Les presses du réel, 2002.

De Certeau, M. (1984): *Walking in the City: the Practice of Everyday Life.* Berkley: University of California Press.

Farman, J. (2014). Creative misuse as resistance: Surveillance, mobile technologies, and locative games. *Surveillance & Society,* 12(3), 377-388.

Frota, G. & Rauscher, B. (2013). Charretenet ciberatrações: arte e ativismo na cidade. *22º Encontro Nacional da Associação dos Pesquisadores em Artes Plásticas*, 3579-3594.

Frota, G. (2014) CiberÀtrações, CharreteNet e CarROBOis. Catálogo Rede Nacional Funarte Artes Visuais 2013 - 10ª edição. 48-51. < http://www.funarte.gov.br/programa-rede-nacional-funarte-artes-visuais-catalogo-2013-2/>

Haraway, D. (2000). A Cyborg Manifesto: Science, technology, and socialist-feminism in the late twentieth century. *The Cybercultures Reader*, 291-324.

Hight, J. (2006). *Narrative Archaeology: reading the landscape*. Retrieved from http://newmediafix.net/daily/?p=638

Ippolito, J. (2002). Ten myths of Internet art. *Leonardo*, 35(5), 485-498.

Kitchin, R. (2014).The real-time city? Big data and smart urbanism. *GeoJournal*, 79(1), 1-14.

Manovich, Lev. The poetics of augmented space. *Visual Communication*, 5(2), 219-240.

Nardin, H. O., & Boel, A. R. (2013). As artes visuais no contexto urbano: a estética de ciberatrações. *22º Encontro Nacional da Associação dos Pesquisadores em Artes Plásticas*, 3387-3399.

Negri, A. & Hardt, M. (2012). *Commonwealth*. Stock.

Rancière, J. (2013). *The politics of aesthetics*. A&C Black.

Rauscher, B. B. (2013) Pelas bordas: a cidade como território sensível. *Revista Gama, Estudos Artísticos,* 1(1), 20-25.

Rena, N., Berquó, P. & Chagas, F. (2014). Biopolíticas espaciais gentrificadoras e as resistências estéticas biopotentes. *Revista Lugar Comun*, 41, 71-88.

Soja, E. W. (2000). *Postmetropolis: Critical Studies of Cities and Regions*. Blackwell: Malden.

Sotelo-Castro, L. C. (2010). Participation cartography: blurring the boundaries of space, autobiography, and memory by means of performance. *Research in Drama Education: The Journal of Applied Theatre and Performance*, 15(4), 593-609.

Southern, J. (2016). Locative Awareness – A Mobilities Approach to Locative Art. *Leonardo Electronic Almanac*, (21)1, 178-193.

Tuters, M. (2004, April). The locative commons: situating location-based media in urban public space. *Electronic Proceedings of the 2004 Futuresonic Conference*.

Tuters, M. & Varnelis, K. (2006). Beyond Locative Media: Giving Shape to the Internet of Things. *Leonardo*, 4, 357-363.

Authors Biographies

Vanessa Santos is a digital media artist and researcher. She holds a Ph.D. in Social Communication (2017), from Pompeu Fabra University. Her expertise is in audiovisual production, digital storytelling, interactive systems, locative and mobile media. She has collaborated with research groups involved in the study of the following topics: technology inclusion, socio-tech networks, open source software for multimedia production, virtual and augmented reality based systems to experience complex data sets. The artist is interested in the creative use of technology and in the stimulus that it entails in the formulation of new narrative genres. In 2014, she integrated the research line on Locative Media of *Hangar Center for Visual Arts*. Her last work is "Chronica Mobilis", an interactive and geolocated performance with gameplay, which happens in public space. Currently, she investigates the audience experience in response to different modes of engagement.

Gastão Frota works with public Art propositions, performances and intermedia related to open source tools and activist context. He teaches Visual Arts at the *Instituto de Artes* of *Universidade Federal de Uberlândia* Currently, he is a researcher at *Universidade de Lisboa, Faculdade de Belas Artes, Centro de Investigação e de Estudos em Belas-Artes*, where he is PhD candidate on Multimedia. He holds a master degree in Visual Arts from the Pratt Institute (NY-USA). Lives between Lisbon, Belo Horizonte and Uberlândia.

Be Sicklecell Be a Hero: Xenofantasies in Transparent Scenarios

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Abstract

This paper presents and discusses the poetics and concepts woven in the conception of the interactive media art and science installation *'Entrancer: Be Sicklecell Be a Hero'* (2018) inviting for a reflection concerning issues of race in science research mainly related to the sickle cell anemia. The work invites for the experience of a possible dance with a virtual moving model of a sickle-cell in AR (Augmented Reality) – mutated from the 3D model of a normal blood cell using morphogenetic algorithmic strategies. The experience is conducted by the rhythm of a Brazilian samba (live recording) distorted and combined with sonified fragments of sickle-cell image's textures under the microscope (imported as raw data to Adobe Audition). The samba metamorphoses into its distorted version resembles the mutant sickle-cell that changes shape due to a chemical alteration that can be a strategy against malaria – and not a genetic condition of black men and women. At the same time the installation is a tribute to emblematic works of Hélio Oiticica, bringing together in a conceptual combination or convergence the 'Parangolé' and the stencil 'Be an Outlaw Be a Hero' from the series 'Marginalia', proposing a piece that is a 'cross-over' of both referred works, that has adaptive qualities concerning the most diverse exhibition conditions and spaces, and that is itself a mutant work in relation to the body and the environment.

Keywords

Augmented Reality, Race, Xenophobia, African American, Sickle Cell anemia, morphogenetic design strategies, parametric modeling, Grasshopper, Hélio Oiticica, Neoconcretism, Parangolé, Marginália, non-object.

Introduction

> "The expression 'non-object' does not intend to describe a negative object nor any other thing that may be opposite to material objects. The non-object is not an anti-object but a special object through which a synthesis of sensorial and mental experiences is intended to take place. It is a *transparent* body in terms of phenomenological knowledge: while being entirely perceptible it leaves no trace. It is a pure appearance. All true works of art are in fact non-objects, if this denomination is now adopted it is to enable an emphasis on the problems of current art from a new angle." (Gullar, 1959 apud Asbury, 2005, p.170)

Figure 1: *'Entrancer: Be Sicklecell Be a Hero'* (2018), AR 3D model of mutant blood cell, experiments at the beach in Fortaleza, Brazil (photo by the author).

The argument that supports and feeds some of the *Entrancer*'s art director Clarissa Ribeiro current aesthetic explorations in media arts and sciences and her poetics in a series she named 'cross-objects', including the installation "Interstellar: Cross-Scale Space-Scapes" (ISEA 2017, Manizales, Colombia; IEEE VIS 2017 Phoenix, Arizona, LIP Gallery UNIFOR - exhibition related to the Leonardo LASER talks Fortaleza, edition of March 2018 on Augmented Reality themed 'Superposed Worlds'), are based on the intention of exploring the technology of Augmented Reality (AR) as the support for an actualization in the media arts and science of 2010s and the upcoming 2020s of the Brazilian Neoconcretism movement expression 'non-object' coined by the poet and theorist Ferreira Gullar in the late 1950s. (Gullar, 1959 apud Asbury, 2005) Gullar was referring to special objects through which a synthesis of sensorial and mental experiences can take place – transparent bodies in phenomenological terms. Ferreira Gullar as member of the Brazilian art movement Neoconcretism is considered its main theorist, establishing the group's discourse framework in two central texts from 1959 - 'The Neoconcrete Manifesto' and 'Theory of the Non-Object'.

Michael Asbury's essay from 2005, offer a comparative study of the aesthetic philosophies of minimalism and

neoconcretism and, for the first time, presenting an English translation of Ferreira Gullar's 'Theory of the Non-Object', opens up the possibility of weaving my arguments with more accuracy in a paper written in English.

The work invites for the experience of a possible dance with a virtual moving model of a sickle-cell in AR (Augmented Reality) – mutated from the 3D model of a normal blood cell using morphogenetic algorithmic strategies. The experience is conducted by the rhythm of a Brazilian samba (live recording) distorted and combined with sonified fragments of sickle-cell image's textures under the microscope (imported as raw data to Adobe Audition). The final sound resembles a Maracatu – or maracatu of inverted beat (maracatu do baque virado), an Afro-Brazilian rhythm and performance genre practiced in the Northeast Region of Brazil. Back in 1990s 'Chico Scince and Nação Zumbi' – a post-punk rock band – proposed appropriations of the rhythm in compositions performed with electric guitars and dramatic drums. One of the iconic performances of the band is a version of Jorge Mautner's 'Maracatu Atômico' (1974). Mautner, who was born in 1941, is a pioneer of the MPB scene and of the Tropicalia movement in Brazil.

Figure 2: *Afrociberdelia*, Chico Science & Nação Zumbi sencond album released in May 15th 1996 in Brazil.

The samba metamorphoses into its distorted version resembles the mutant sickle-cell that changes shape due to a chemical alteration that can be a strategy against malaria – and not a genetic condition of black men and women. At the same time the installation is a tribute to emblematic works of Hélio Oiticica, bringing together in a conceptual combination or convergence the 'Parangolé' and the stencil 'Be an Outlaw Be a Hero' from the series 'Marginalia', proposing a piece that is a 'cross-over' of both referred works, that has adaptive qualities concerning the most diverse exhibition conditions and spaces, and that is itself a mutant work in relation to the body and the environment.

Considering ISEA 2018 main sub-themes, the work can be seen primarily as a contribution on the politics of science encompassing issues of xenophobia, colonial legacies and new powers intersecting with media art practices, addressing the challenges of diversity. At the same time, there is an interface with the sub-theme 'Spirit and Flesh', considering that the work brings issues related to intangible heritage concerning gene mutation and populations genetics integrated in aesthetic and poetic explorations viscerally attached to reality and lived experiences. The work invites to a plural and cross-scale understanding of the self and the body additionally contributing, as an Augmented Reality media art and science installation, to envisage the possibility of having artworks detached to fixed venues, helping in questioning the relevance of the classic museum environment and the potential for public space activations.

The Resplendent Body

> "PARANGOLÉ = the body resplends as a renewable and sustainable source of pleasure; flexible concept of extreme adaptability to the most dissimilar places. Or should the PARANGOLÉ cape stands as the model of a low-tech aesthetics, representative sample of the realm of scarcity such as a fossilized shell or an abandoned cocoon hanging static in a museum, artefact of an archaeological site of a buried past? How will it compete in the fiber optics and internet high-ways surfing era? Classified as technologically incorrect?" (Salomão, 2003, p.27, translation by the author)

Hélio Oiticica's intention pulsating in the Parangolé series dialogues with Ferreira Gullar's Theory of Non-Object. The Parangolé affects behavior inviting for a dance with anarchy – it is embodiable, rescuer, emancipator – having at the same time an ethical and sociopolitical dimension. A Parangolé cannot be reduced to a 'mobile sculpture', it is an exercise of morphogenetic freedom – the invitation for an experience of immersion in a complex body of color, shape and movement that impacts the self that is expanded as the experience goes on, as if the consciousness could be poetically-topologically enlarged.

Gullar's ''Theory of the Non-Object" was published in 1959, in a historical moment in which the 'Jornal do Brasil', one of the most important newspapers by the time, had the openness to publish in its weekend supplement the representative voices of Brazilian Neo-Concretism. Asbury (2005), examining the philosophical reflection on modernism that informs Ferreira Gullar's idea of a 'non-object', relates his discourse to interests in Gestalt psychology and phenomenology of perception, associating the tendency with the minimalism in North America. In his text, Gullar defends that, when painting fundamentally abandons representation as in the case of Kazimir Malevich, Piet Mondrian, and their art circles, there is the emergence of a metaphorical space and so it is "[…] the case of establishing the work of art within the space of reality, lending to this

space, through the apparition of the work – this special object – significance and transcendence." (Gullar, 1959 apud Asbury, 2005, p.171) At some point Guller mentions Moholy-Nagy and specifically his "[…] attempted to create sculptures that would inhabit space without a support." (Gullar, 1959 apud Asbury, 2005, p.172) having, as pointed by the neo-concrete theorist, the intention of eliminating weight from sculpture, affecting, this way, a fundamental characteristic of an object.

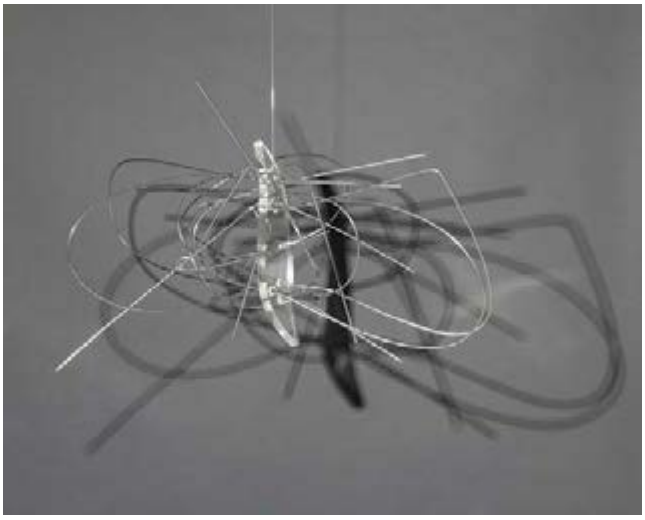

Figure 3. T *Laszlo Moholy-Nagy, Dual Form with Chromium Rods, 1946, Plexiglas and chrome-plated brass, 92.7 x 121 x 55.9 cm (image source: The Moholy-Nagy Foundation)*

According to Walter Gropius, close friend of Laszlo, his greatest effort as an artist was devoted to 'the conquest of space' in Gropius words, venturing into "[…] all realms of science and art to unriddle the phenomena of space and light" in the most diverse areas, incessantly attempting87ui to "[…] interpret space in its relation to time, that is, motion in space."(Gropius, 1959, p. viii). It is patent in Gullar's arguments how the concrete art movement agenda and experimentation works as a *cellula mater* to the Brazilian Neo-concrete movement. Resulting, as pointed by Asbury (2005), from the difficulty encountered in categorizing a work by Lygia Clark, in his 'Theory of the Non-Object' Ferreira Gullar introduces issues that anticipated theoretical debates that would emerge in North America during the 1960s. According to Asbury, "While Robert Morris's interest in Gestalt psychology would suggest a proximity with the theoretical repertoire of concrete art, Donald Judd's text 'Specific Objects' and Ferreira Gullar's 'non-object' present surprising similarities." Asbury points Neoconcretism as one of the key references in what can be seen as a movement of legitimating Brazilian contemporary art that has currently gained international notoriety. Asbury believes that its notoriety is due to the fact that "[…] it has acquired a quasi-mythical status: that of signaling the national origin of contemporary Brazilian art."(Asbury, 2005, p. 177) And it is in Hélio Oiticica and Lygia Clark that the participatory work transcended the contemplative nature of precedent modernist art. Asbury (2005) adds that the gestation of the movement happens during the late1940s and 1950s, at the crest of the wave of optimism that spread through Brazil by the time – a period during which "constructivist-orientated art, and concrete art in particular, was consolidated in Brazil.

Total source of Sensoriality

> "Oiticica called his art environmental. Indeed, that is what it is. Nothing about it is isolated. There is no single artwork that can be appreciated in itself, like a Picture. The sensorial perceptual whole dominates. Within it, the artist has created a 'hierarchy of orders' – Relevos [Reliefs], Núcleos, Bólides (boxes), and capes,banners, tents (Parangolés) – 'all directed toward the creation of an environmental world." (Pedrosa, 2016)

Figure 4. People on the streets of Mangueira neighborhood wearing the Parangolés: P 25 Parangolé Capa 2 'Xoxoba' (1968), P 08 Capa 05 'Mangueira' (1965), P 05 Capa 02 (1965), P 04 Capa 01 (1964), during the production of the movie HO, directed by Ivan Cardoso, 1979.

According to Mario Pedrosa in his seminal essay from 1966 'Environmental Art, Postmodern Art, Hélio Oiticica', renowned for its early use of the term 'postmodern', it was during Oiticica's initiation in samba that the artist "[…] moved from the purity of visual experience to an experiment in touch, in movement, in the sensual fruition of materials in which the entire body – previously reduced in the distant aristocracy of visuality – makes its entrance as a total source of sensoriality." (Pedrosa, 2016) For Pedrosa, in Oiticica, "the Luciferiam sin of aesthetic nonconformity and the individual sin of psychological no conformity are fused. The mediator of this symbiosis of two Manichaean nonconformisms was the Mangueira Samba school."(Pedrosa, 2016)

Envisaging the possibility of having artworks detached to fixed venues, helping in questioning the relevance of the

classic museum environment and the potential for public space activations, we name the series "Entrancers", proposing for ISEA 2018 in Durban different possible configurations of it, mainly contemplating actions and interventions in public spaces as part of the ISEA cultural journey. An Entrancer can be the one who uses an entrance or becomes an entrance itself or that becomes one with an entrance and, additionally, can be entrance by the experience itself, considering entrance (noun), meaning an act of entering or something that provides a way to enter something (pronouncing putting the accent on the first syllable), and entrance (verb) meaning to enchant, fascination, magic (If the accent is on the second syllable).

Back in 1996, Roy Ascott presented a lecture at the Total Museum Conference at the Art Institute of Chicago, titled 'The Digital Museum' suggesting the obsolescence of the museum, criticizing the museum's curatorial limitations based on the participatory nature of art as experience and event, and particular notions of authorship and collaboration amplified as a possibility in the digital era. The Brazilian art historian Simone Osthoff was there and included her annotations and considerations about Ascott's talk in an essay that integrates a Leonardo ISAST special project titled "A Radical Intervention: The Brazilian Contribution to the Electronic Art Movement" (1997), guest edited by Eduardo Kac. As highlighted by Osthoff (1997), "continuing championing a new architecture of connectivity, Ascott calls for spaces that enable the emergence of new realities. He envisions a museum that is adaptive to complex and increasingly immaterial systems." (Osthoff, 1997)

In the essay Osthoff discusses the artistic legacy of Hélio Oiticica (1937-1980) and Lygia Clark (1920-1988) focusing on the interactive vocabularies and pointing to the practical and conceptual relevance of their developments for artists working with digital technology, emphasizing the syncretic character of their strategies that led to a fusion of two traditions – "a Western aesthetic canon that privileges vision and metaphysical knowledge, and Afro-Indigenous oral traditions in which knowledge and history are encoded in the body and ritual is profoundly concrete."(Osthoff, 1997) The art historian remembers that Oiticica's radical series Parangolés, initiated in 1964 in Rio de Janeiro, was revisited in the early 1990s by the X-Art Foundation in New York City recreating many colorful wearables that could be worn by participants both at the exhibition space of the Sandra Gering Gallery, and by the ones who accessed the virtual space of Blast's MOO (Multi-User Object-Oriented Dimension, an online text-based form of virtual reality). As participants wore the virtual Parangolés in the MOO, the computer screen was projected on the gallery wall, displaying the interaction between gallery visitors and remote participants. Osthoff argues that the X-Art Foundation initiative unveil affinities and influences of Oiticica's participatory paradigms to the telematic arts of the 1990s. In Osthoffs understanding, Roy Acott's view presented at the Total Museum Conference at the Art Institute of Chicago contrasts radically with some curatorial postures that presents Oiticica's works, specifically the Parangolé series, as in his retrospective in 1993 at the Walker Arts Center, that relegates its participatory aspect to past events and "[…] viewers, paradoxically, were distanced further from the experience of the Parangolés by being encouraged to locate these uncanny creations in the past expressions of a distant culture's exotic dance." (Osthoff, 1997) And this is exactly the connection we meant to highlight and expand here as a contribution to ISEA 2018 conversations – the one that viscerally links a Brazilian and African live cultural heritages. A connection that makes it explicit the beauty of shared cultural values that have the sensorial at the forefront, which enlarges space, consciousness and the body, in a complex and cross-scale sense. Cultural heritages in which bodies are perceived not as isolated entities, like armors or shells to the fragile spirit, but as moving light in space, as the spirit itself – free and open to recombination, mixture, permeable to sound and color, and to the darkness as well.

Morphogenetic Heritages

Reductionist points of view can be helpful sometimes when one needs to make a choice in fractions of a second. Nevertheless, most of the time, they hide important subtleties and complexities and can feed prejudice, discrimination and segregation, having the power of not only psychologically damage the ones who are 'classified' as belonging to an unprivileged or abnormal dualistic category as health and sick, black and white, boy and girl, it can cost people's lives. Recent researches in Psychology (Mays, Cochran and Barnes, 2007), using newly emerging methodologies in both measurement of contextual factors and functional neuroscience show how race, racial prejudice, and race discrimination shape human experience and have harmful effects on health.

With almost 60 million citizens with African origins, Brazil ranks first among the countries with highest black population outside Africa. The second in the rank is the United States. Both countries have a long history of racial discrimination and, as one of the direct consequences, long-run trends in racial differences in health in the founding distribution in science research. Sara Reardon introduces a brief article discussing the initiative of the US agency NIH to assess whether grant reviewers are biased against minority applicants, with the following reflection – "Richard Nakamura, director of the Center for Scientific Review at the US National Institutes of Health (NIH), does not consider himself to be racially biased. Yet a test of his speed at associating certain words with faces of different races revealed a slight unconscious prejudice against minorities. If the director of the institute that oversees the NIH's grant process harbours these inclinations, he wonders, are grant reviewers affected as well?" (Reardon, 2014) The analyses launched by NIH agency in 2014 intend to determine whether bias hampers minority scientists who seek agency funding. A 2011 study in Science (Ginther, 2011) found that white researchers

receive NIH grants at nearly twice the rate that African American researchers do even when factors such as publication record and training are equivalent. In statistical analysis such as the one presented by Leah Boustan and Robert Margo (2016) shows that despite racial disparities in health have narrowed substantially over the course of the twentieth century in the US, there still remain medically and economically significant gaps in health outcomes by race. The panorama is not different in Brazil. In a book where he offers an overview and a comparative analysis on 'Race and Multiraciality in Brazil and the United States' (Daniel, 2006) G. Reginald Daniel, Associate Professor of Sociology at the University of California, Santa Barbara, presents search results indicating that, in Brazil, the more phenotypically African the individual, the lower he or she was in the social order in terms of education, occupation, and income despite the lack of legal barriers to equality. According to the researcher,

> "Notwithstanding the contradiction between the reality of race relations and the ideology of racial democracy, these findings, along with research conducted in the early 1970s by U.S. scholars indicated that Brazil exhibits fluid racial markers. However, during the two decades of military rule (1964–85) Brazilian scholars were largely prohibited from discussing the problem of racial inequality by a government invested in claiming that no such problem existed." (Daniel, 2006)

It is important to say that the fact racial inequality issues in Brazil were prohibited from being discussed, ignored and hidden by the government during the military regime in Brazil emphasize the responsibility in promoting empowerment of marginalized communities and their cultural heritage, unveiling issues explored by Hélio Oiticica with both the Parangolés and the series 'Marginália' with the stencil 'Be an outlaw Be a Hero´.

Figure 5: Hélio Oitica Stencil Seja Marginal Seja Herói (Be an Outlaw Be a Hero), 1968, Black ink on cloth, 37 3/8 x 45 1/4 in. (95 x 115 cm), Signed by César Oiticica Filho on the reverse. (Phillips, 2017)

The intention in proposing the present reflection encapsulated in the conception of a media art and science installation is to contribute to the debate around these issues and to help spreading the knowledge about the need to approach such problems openly in the most diverse forums.

Generative Alterations

Sickle cell disease (SCD) is the most widespread hereditary blood disorder in the United States. It affects about 72,000 individuals and is at the same time the most common inherited disease among African Americans. According to the Brazilian government agency FAPES, sickle cell anemia is the most prevalent hereditary disease in Brazil, and it is estimated that there are more than 50,000 cases (Toledo, 2017).

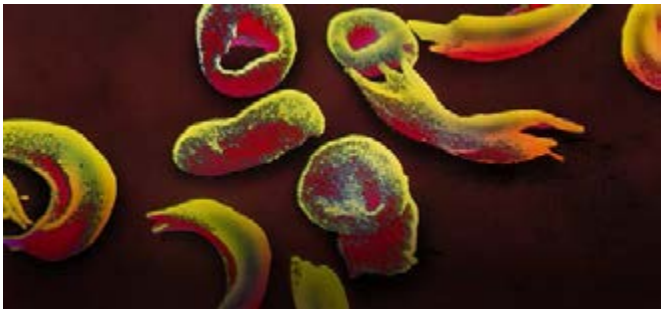

Figure 6: The shape of the disease: the red blood cells are shaped like sickles, which means that they cannot transport as much oxygen (Bayer, 2015) (copyright: Omikron Science/Gettyimages, Josh Edelson).

Despite it affects primarily the African Americans in both cases, Brazil and USA, people of other races are also affected by SCD – "[…] a significant prevalence of the mutation responsible for sickle cell has been reported among other ethnic groups such as those native to Italy, Greece, Turkey, Saudi Arabia, India, Pakistan, Bangladesh, China, and Cyprus." (Ndefo et al, 2008) The sickle cell gene is caused by a single amino acid mutation in the beta chain of the hemoglobin gene,

> "[…] characterized by a structural abnormality in the beta-globin chain of the hemoglobin molecule within the red blood cells (RBCs). The sickle mutation is a single base change (GAT → GTT) in the sixth codon of exon-1 of the beta-globin gene on chromosome 11. This change leads to the synthesis of the beta-globin polypeptide of the hemoglobin molecule. This mutation causes the replacement of the normal glutamic acid with valine acid, thus resulting in the formation of the sickle cell hemoglobin (HbS). This hydrophobic aminoacid substitution causes the hemoglobin to take on a "sickle" shape when in a deoxygenated state." (Ndefo et al, 2008)

As confirmed by Michael Aidoo and his collaborators (Aidoo et al, 2002), in a paper where the protective effects of the sickle cell gene against Malaria is discussed, inheritance of the mutated gene from both parents leads to sickle cell disease. On the contrary, the individuals that have some protective advantage against Malaria, who are carriers for the sickle cell disease, have one sickle gene and one

normal hemoglobin gene from their parents. This condition (not a disease) is identified as 'sickle cell trait'. As pointed by the team of researchers (Aidoo et al, 2002), as a result, the frequencies of sickle cell carriers are high in malaria-endemic areas. In a paper recently published in NATURE Heredity, research partners from the Institute of Evolutionary Biology, School of Biological Sciences, University of Edinburgh, described the astonishing changes and progress that have occurred in the field of population genetics over the past five decades, concentrating on the earlier history of the field. The researches mention seminal works including the one by Allison A. C. (Allison, 1964), relating cells polymorphism and natural selection in human populations,

> "Ecological geneticists had demonstrated the action of selection on conspicuous polymorphisms such as the shell colour and banding variants of Cepaea nemoralis (Ford, 1975), and the sickle cell human haemoglobin variant had been shown to be maintained by heterozygote advantage caused by resistance to malaria (Allison, 1964). These studies showed that natural selection could be a powerful force influencing variation within species."(Charlesworth and Charlesworth, 2017)

The convergence proposed here, includes an appropriation of the notion of morphogenesis in the artist poetics promoting a complex interrelation that historically connects studies of population genetics in Evolutionary Biology running computation simulations on heredity (Dawkings, 1987), with contemporary strategies for the generation of form making with the use of algorithms in Architecture, Visual Arts and Product and Graphic Design, that had evolved drastically along the last 20 years and that are part of my research interests and production since the late 1990s.

Be Sicklecell Be a Hero

Figure 7: *'Entrancer: Be Sicklecell Be a Hero'* (2018), exhibition at the LIP Gallery related to the LASER talks Fortaleza edition of March 2018 on AR, hosted by Clarissa Ribeiro (video frame and photo by the author).

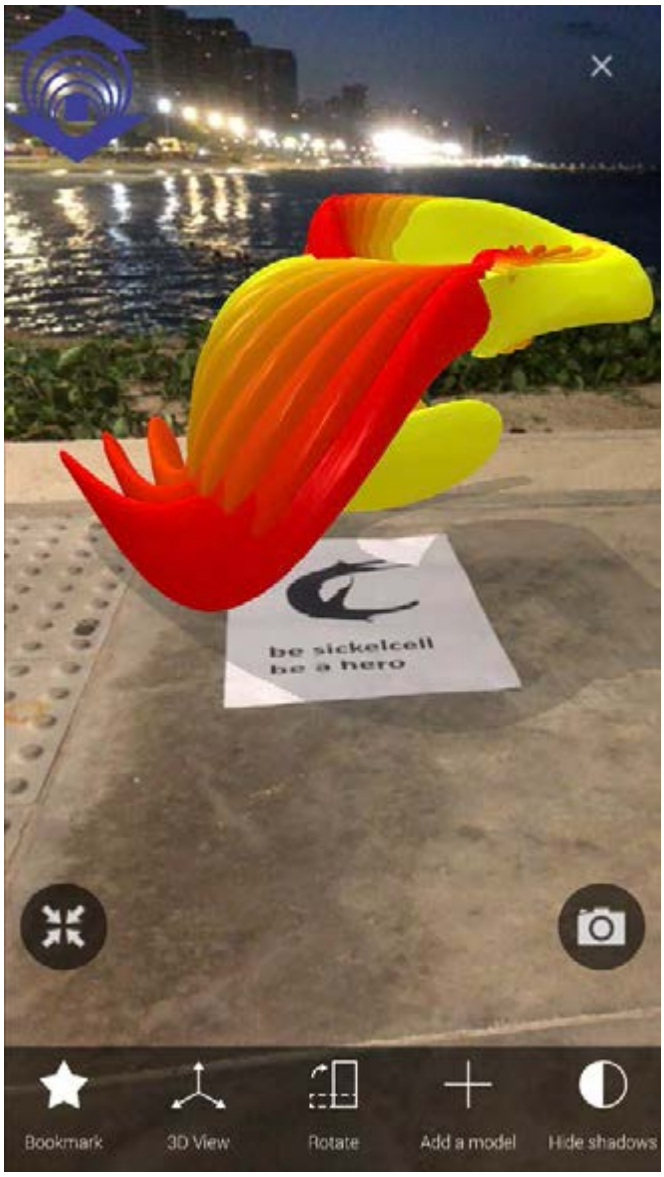

Figure 8: *'Entrancer: Be Sicklecell Be a Hero'* (2018), AR 3D model of mutant blood cell, experiments at the beach in Fortaleza, Brazil (photo by the author).

The installation *'Entrancer: Be Sicklecell Be a Hero'* (2018) can be seen as a gene for several possible installations, adaptive to the most diverse contexts and venues. The intention in proposing, discussing and presenting at ISEA 2018 is to offer the participants the experience as a key or entrance to gain awareness about the relativistic nature of self, its mutant existence and expression, emergence from cross-scale relations and conversations that can take place in several places at once. When you are invited to a dance with human's micro scale universe characters – mutated bloody cells, you are receiving not only the invitation to deconstruct an issue of race that directs resources in science research around the world, but an invitation to deconstruct a limiting and mutilated understanding about nature itself.

Figure 9: *'Entrancer: Be Sicklecell Be a Hero'* (2018), AR tracker – stencil in a t-shirt, experiments for ISEA 2018 cultural journey (photo by the author).

Figure 10: *'Entrancer: Be Sicklecell Be a Hero'* (2018), AR tracker

The intention in *'Entrancer'* (2018) is not to recreate the Parangolés but to propose an appropriation of Oiticica's strategies to openly discuss, in a sensorial conversation and critical reflection that involves the entire body, around pressing issues of race related to the administration of financial resources in science research. Every year, in Brazil, sickle cell anemia kills more people (mainly African Americans) than HIV. '*Entrancer: Be Sicklecell Be a Hero'* (2018) invites for a corporeal conversation with a virtual entity and recalls practices where a corporeal conversation with spiritual beings is a ritual of empowerment that can offer a cure, healing, if one offers the self.

Acknowledgements

The first author and art director would like to thank the team that locally and remotely collaborated in the production of the version of the installation presented here: Herbert Rocha and Daniel Valente (Lapin, UNIFOR, Fortaleza, Brazil), Dr. Stavros Didakis (I-DAT University of Plymouth, UK). A special thanks to Candice Ribeiro, specialist in Dental Public Health (DPH) for the conversations about Sickle cell disease (SCD) mechanisms, and to Clara Reial, Daniel Lenz, Andressa Hadig Haidar, Jéssica Bezerra, Sara Fernanda, Isabela Paiva, Roberta Dutra, Isis Silva, Lucas Cabral, Giovane Borges Junior, for the patience and enthusiasm in experiencing the very first versions of the work.

References

Aidoo, Michael et al. Protective Effects of the Sickle Cell Gene Against Malaria Morbidity and Mortality. RESEARCH LETTERS. THE LANCET, Vol 359, April 13, 2002, 359, 2002, p. 1311-1312.

Allison AC. Polymorphism and natural selection in human populations. Cold Spring: Harbor Symposium on Quantitative Biology. 1964; 24: 137–49.

Asbury, Michael (2005) Neoconcretism and minimalism: on Ferreira Gullar's theory of the non-object. In: Cosmopolitan Modernisms. InIVA / MIT, pp. 168-189

Bayer Research. Treatments for sick blood cells. New therapeutic approaches for hemoglobin disorders. Bayer research, v. 28, July 2015, 43. Retrieved from: https://www.research.bayer.com/img/kvs/magazine/28/titelbild_blutkoerperchen.jpg

Boustan, Leah; Margo, Robert. RACIAL DIFFERENCES IN HEALTH IN LONG-RUN PERSPECTIVE: A BRIEF INTRODUCTION. In: Komlos, John; Kelly, Inas. The Oxford Handbook of Economics and Human Biology. New York: Oxford University Press, 2016

Charlesworth, B; Charlesworth, D. Population genetics from 1966 to 2016. NATURE Research Journal, Heredity (2017) 118, 2–9 Official journal of the Genetics Society.

Cooper, Richard S. Genetic Factors in Ethnic Disparities in Health. In: Anderson, Norman B.; Bulatao, Rodolfo A.; Cohen, Barney (ed.). Critical Perspectives on Racial and Ethnic Differences in Health in Late Life, Panel on Race, Ethnicity, and Health in Later Life, Committee

on Population, Division of Behavioral and Social Sciences and Education. National Research Council of the National Academies. Washington D.C.: The National Academies Press, 2004.

Daniel, G. Reginald. Race and Multiraciality in Brazil and the United States. Pennsylvania: THE PENNSYLVANIA STATE UNIVERSITY PRESS, 2006.

Dawkins, Richard. The Blind Watchmaker: Why the Evidence of Evolution Reveals a Universe without Design. London: W. W. Norton & Company Inc., 1987.

Favaretto, Celso F.. Vanguarda Brasileira: Hélio Oiticica. Porto Alegre: Porto Arte, v.4, n.7, p. 27-42, Maio de 1993.

Ginther, D. K. et al. Race, ethnicity, and NIH research awards. Science, 333, 1015–1019, 2011.

Pedrosa, Mario. Environmental Art, Postmodern Art, Hélio Oiticica. In: Mario Pedrosa Primary Documents. New York: MoMA, 2016.

Mays, Vickie M. ; Cochran, Susan D.; Barnes, Namdi W.. Race, Race-Based Discrimination, and Health Outcomes Among African Americans. Annu Rev Psychol. 2007; 58: 201–225.

Ndefo, Uche Anadu et al. Pharmacological Management of Sickle Cell Disease. Pharmacy and Therapeutics, 2008 Apr; 33(4): 238–243.

Gropius, Walter. Introduction. In: Moholy-Nagy, Sibyl. Moholy-Nagy: Experiment in Totality. Cambridge: MIT Press; 2nd edition (October 1969)

Osthoff, Simone. Lygia Clark and Hélio Oiticica: A Legacy of Interactivity and Participation for a Telematic Future. In: Leonardo special project: "A Radical Intervention: The Brazilian Contribuition to the Electronic Art Movement" guest edited by Eduardo Kac, 1997. Retrieved from: https://www.leonardo.info/isast/spec.projects/osthoff/osthoff.html

Phillips. HÉLIO OITICICA,Seja Marginal Seja Herói (Be an Outlaw Be a Hero)1968, Black ink on cloth, 37 3/8 x 45 1/4 in. (95 x 115 cm), Signed by César Oiticica Filho on the reverse. Retrieved from: https://www.phillips.com/detail/HELIO-OITICICA/NY000211/1Phi

Reardon, Sara. NIH to probe racial disparity in grant awards US agency will assess whether grant reviewers are biased against minority applicants. Nature, 21 August 2014, v. 512, 243. United States: Macmillan Publishers Limited, 2014.

Salomão, Waly. 1943-2003 Hélio Oiticica: Qual é o parangolé? e outros escritos. Rio de Janeiro: Rocco, 2003.

The Moholy-Nagy Foundation. Laszlo Moholy-Nagy, Dual Form with Chromium Rods, 1946

Plexiglas and chrome-plated brass, 92.7 x 121 x 55.9 cm. Retrieved from: http://moholy-nagy.org/

Toeldo, Karina. AGÊNCIA FAPESP: Scientists from Brazil and France create a consortium to research sickle cell anemia. AGÊNCIA FAPESP: July 10, 2013. Retrieved from: http://agencia.fapesp.br/scientists_from_brazil_and_france_create_a_consortium_to_research_sickle_cell_anemia_/17514/

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Candice Ribeiro, Dentist, specialist in Dental Public Health (DPH) and Orthodontics. She has been collaborating with Clarissa Ribeiro in projects exploring public health related issues.

Heaven and Hellscapes: Exploring Altered Mind States through Procedural Environments

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Keywords
videogame, neurosciences, spirituality, psychedelic, artgame, simulation, landscape, docugame, dream, abstract

Abstract
This paper discusses the results of several original digital game design experiments where generative landscapes are created to reference states of consciousness. Their designs take inspiration from hypnagogic states, geographically-located psychic trauma and dream-states, unconscious player input, dissociative worlds, and landscapes as autonomous, emotional entities. This series is a work-in-progress that points to future paths in expressive generative landscape design.

Introduction

Algorithms for procedural generation of videogame environments often draw from evolutionary science and artificial intelligence theory to construct levels that are functional and challenging for players. [1] Rarely are they used to create environments that cause players to reflect on states of mind and draw connections between the creations of the brain and creations of the external natural world. The following are descriptions of completed videogames where I explore states of mind through interactions with and explorations of generative landscapes. They are inspired by psychedelics, spiritual encounters, everyday hallucinations, and the uncontrollable natures of interpretation and memory.

Projects

Islid (2016): Hypnagogic State as Landscape

The world of the videogame *Islid* is one that emulates the ephemeral images of hypnagogia, the visions passing before one's eyelids before sleep. [2] On a two-dimensional plane, the player guides a flickering speck through randomly-arranging visions. I created these visions by shining a light into my eyes, closing them, then drawing and animating the mutating shapes from memory. The world the player is traversing has the texture of the dark inner lining of the eyelid, and the shapes come in and out of vision with the peripheral persistence of the hypnagogic state.

Although this is inspired by a landscape that one encounters internally, the patterns formed by the brain in a state of play mirror those that the outside, natural world produces in its own procedural generation. Neuroscientist Oliver Sacks draws a comparison between the "spontaneous self-organization" of populations of visual neurons as a part of perception, and the geometric formation of snow crystals. In the latter example, "self-organization can produce geometries and patterns in space and time very similar to what one may see in a migraine aura. In this sense, the geometrical hallucinations of migraine allow us to experience in ourselves not only a universal of neural functioning but a universal of nature itself". [3] Whether creating hypnagogic visions or migraine auras, our brains produce geometric landscapes in a manner similar to that of the physical world. In a nod to its connection to external, earthly formations, the title of the game is a combination of "island" and "eyelid."

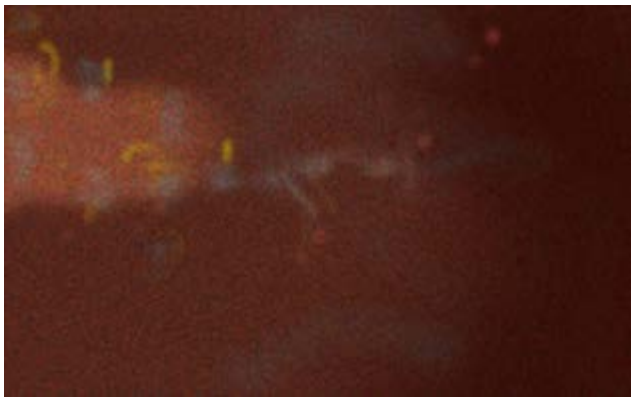

Fig 1. *Islid*, 2016, screenshot, ©Author.

The medium of digital play-spaces is also appropriate as a metaphor for this state, as hypnagogia is described as:

> the visual cortex playing with every permutation, playing with no goal, no focus, no meanings—a random activity or perhaps an activity with so many microdeterminants that no pattern is ever

> repeated. Few phenomena give such a sense of the brain's creativity and computational power as the almost infinitely varied, ever-changing torrent of patterns and forms which may be seen in hypnagogic states. [4]

It is essentially interactive, procedural seeing, with little information required from the outside world. It is a reminder of how much of sight is created by the brain in a response to stimulus. In the case of hypnagogic sight, the required stimulus is essentially a random seed.

Cho-Am (2016): Navigating a World of Invisible Trauma

The videogame *Cho-Am*'s world is generated through parameters that are limited by a real-world referent. [5] It is based on the cremation site of Pol Pot in Cho-Am, northern Cambodia. In this game, based on documentation I collected from the site, the player controls the avatar of a sleepwalker, whom they imperfectly guide through the landscape. This sleepwalker, through their psychological presence in a world the player cannot see, explores the invisible history of the site, and the memories of those who passed through and were affected by the autogenocidal regime of the Khmer Rouge and Pol Pot.

Fig 2. *Cho-Am*, 2016, screenshot, ©Author.

When this world is constructed upon execution of the software, with time of day based on the current local time in Cambodia, invisible encounters are placed throughout the world. When the avatar passes through one of these encounters, the player only sees what their avatar is experiencing through pantomime. Sometimes, the game gives the player a brief glimpse inside of the avatar's head, with a vision of a mundane object from the life of Pol Pot. He and his victims are psychically present in this empty space, filled with the sounds of insects. The player is left to interpret vignettes as potentially related to survivor PTSD, or the spiritual presence of Pol Pot.

Fig. 3. *Cho-Am*, 2016, screenshot, ©Author.

Games critic Lana Polansky, writing on her blog Sufficiently Human, discusses the necessity of *Cho-Am* existing in a dream space:

> It's my belief that unresolved historical trauma has a sort of collective transference property. That is to say, the original pain doesn't really go away. It just sort of gets moved somewhere else; attempts to rationalize or contain it usually burst at the seams, and all that latent hurt spills over into something that can freshly exploit it. [6]

One could imagine the physical space represented by the game as a sort of transit stop for this trauma, as it infests the ground and mundane environmental objects.

Brief Excursion (2016): Geography Reacts to the Unconscious

The landscape in *Brief Excursion* is altered by readings from a toy Mindflex neural headset, hacked to connect to the videogame via USB. [7][8] The player explores this environment, which is endlessly creating itself as they traverse it, while wearing the device. The data the device sends to the computer, according to the creators of Mindflex, corresponds to the player's brain's mid-gamma waves. There is debate as to what the device is actually reading, whether it is the brain waves themselves, or the forehead's muscle movements. Regardless of how the device works, the game presents a way of thinking about neural game controls. Generally, these controls focus on the player intentionally manipulating the environment by controlling their own thought states, for a task such as moving an object. *Brief Excursion*, however, relies on the player's lack of control. The player is exploring the unintentional creations of their subconscious, how their brain states, which they might try to control, change their perceived environment.

It was through accident that I chose gamma waves from the array of data that the Mindflex produces. I chose them due to the interesting fluctuations in the

readings, not knowing the potential significance of these waves. These waves are thought to be responsible for the brain's interpretation of individual parts as a coherent object, and likely ties back to the brain's self-organizing patterns, its way of creating vision out of retinal data. This is the brain's, unity of conscious perception, also known as "binding". [9]

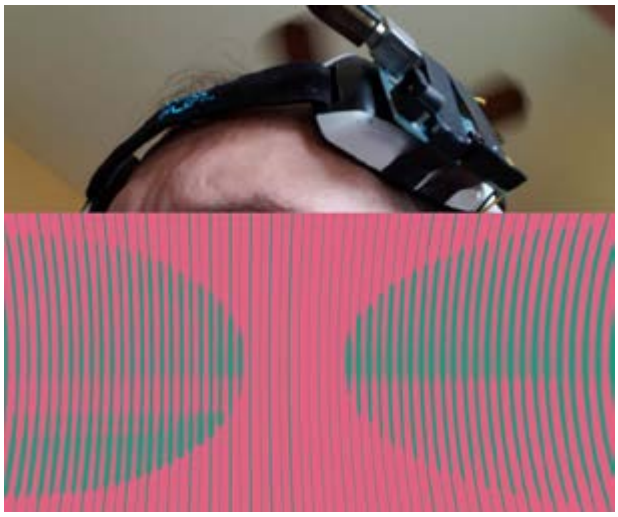

Fig. 4. *Brief Excursion*, 2016, headset and screenshot, ©Author.

This game points to the possibilities, with the use of more sensitive neural headset technologies, of generating worlds based on a variety of the player's mental states, allowing the player to see and explore their minds from a distance.

Fig 5. *Thinning*, 2016, screenshot, ©Author

Thinning (2016): A Dissociative Terrain

The world in *Thinning* curves and repeats, in a manner inspired by an encounter with the atypical psychedelic salvia divinorum. [10] The player, beginning as the protagonist in a game that appears to take the form of a standard "roguelike" procedurally-generated dungeon crawler, loses their sense of time and location, their context as an individual in space. It is an attempted simulation of depersonalization.

As one moves through the rooms of *Thinning*, the camera zooms out to show the same room repeated through twisting space. The player then traverses the space of the infinitely-repeating map, itself. It also resembles the world described by the patient "Miss R" in Oliver Sacks's *Awakenings*:

> I think of a map; then a map of that map; then a map of that map of that map, and each map perfect, though smaller and smaller . . . Worlds within worlds within worlds within worlds . . . Once I get going I can't possibly stop. It's like being caught between mirrors, or echoes, or something. Or being caught on a merry-go-round which won't come to a stop.' [11]

As a survivor of the sleeping sickness, encephalitic lethargica, this is a world in which she was trapped for decades. It is bleak and identity-less, dissociating from space as well as time.

Fig. 6. *Thinning*, 2016, screenshot, ©Author

In his book, *Spiritual Doorway in the Brian,* neurologist Kevin Nelson describes the "introvertive" mystical experience as one where "the sense of being a separate self of thoughts, feelings, sensations, volitions, and memories is lost and transcends into the One. Time and space dissolve". [12] The landscape in *Thinning*, created in an intradimensional repetition of the second dimension, is created through rules that disrupt the player's sense of individuality and purpose. The world of *Thinning* creates a sense of space for the player, then removes that sense through iteration.

Fig. 7. *Desert Mother*, in process, screenshot, ©Author

Desert Mother: The Passionate Landscape

In his book, *Phantoms in the Brain*, neuroscientist V.S. Ramachandran breaks down the concept of self into eight characteristics: the embodied, passionate, executive, mnemonic, unified, vigilant, conceptual and social selves. One could categorize the procedural landscapes we are discussing as exploring some of these concepts of self. The mnemonic self, in its construction of self through memory, "as a single person who endures through space and time", finds its representation in *Cho-Am*'s approach to distributed memory. [13] Though the landscape psychically embodies the collective memory of multitudes of people, it can be thought of as a being with a self that is created through memory.

In *Brief Excursion*, through its reliance on the brain's gamma waves, the player's own possible sense of unity and coherence, could be seen to be constructed by the player's unified self. This is the self that is responsible for "filling in and confabulation", the existential variation on the visual concept of binding.

My current work in progress, *Desert Mother*, creates a landscape that embodies the passionate self. [14][15] It is a landscape that responds emotionally to the player's bodily actions. These actions are subtle, as the player sits in a desert environment, breathing, stretching, observing, in a circle with other players across a network. The landscape records the player's actions in memory, which often trigger a change in the environment's emotional state. This state controls all of the environmental objects, flora and fauna, with behaviors related to the environment's emotion. The emotions revolve around spiritual states, as the personality of the landscape derives from the early Christian ascetic and hermitic desert mothers.

It is also partly inspired by a quote from Daniel Paul Schrieber's account of his lifelong psychosis, *Memoirs of My Nervous Illness*:

> I think one is entitled to assert that divine intelligence equals at least the sum total of all the intelligences of previous generations of human beings. For God assimilates all human nerves after death and thus unites the sum total of their intelligences in Himself while gradually divesting them of those recollections which are of interest only to the individual but of no use as part of a universally valuable intelligence. [16]

Desert Mother is a multiplayer game, where the environment records the actions of all players, assimilating one's memory remains after they have left the game, or "died". Here, divine intelligence is in the procedurally-generated natural world, activated by the people who have come and gone. Walter Pahnke, in his interpretation of William James' 1898 Ingersoll Lecture on human immortality, suggests that "the physical brain is necessary only as a means to transmit a part of [a] Larger Consciousness into the dimension of ordinary realty perceived by individual normal waking consciousness. If an individual brain is damaged, disintegrates, or dies, this Larger Consciousness does not cease". [17] The brain is essentially a filter for this larger consciousness, letting through only a fraction of the range of consciousness. Through this multi-user mnemonic environment, my intention is to simulate some of this give and take between the larger and individual consciousnesses.

Next Steps

As I continue this series of intelligent landscapes, the facets of altered states of consciousness to explore in generative environments are varied. There are potential landscapes that can simulate the way in which one psychically inhabits one's own body, forests that can express fluid cognitive interpretations of time, and invisible gaseous worlds that express the consciousnesses of other animals—to go beyond external behavior and empathize with abstracted cognitive processes through game mechanics.

Perhaps one important potential of this field of exploration, is the ability to provide a space for empathy for a wide variety of neural types and experiences, in others and oneself.

References

1. Julian Togelius, Noor Shaker, and Mark J. Nelson. (2016). *Procedural content generation in games: A Textbook and an Overview of Current Research*. New

York, NY: Springer. Retrieved November 13, 2017, from http://pcgbook.com.
2. Author. (2016). *Islid*. USA: Author.
3. Oliver Sacks. (2013). *Hallucinations*. Waterville, Maine: Thorndike Press, 132.
4. Oliver Sacks. (2013). *Hallucinations*. Waterville, Maine: Thorndike Press, 208.
5. Author. (2016). *Cho-Am*. USA: Author.
6. Lana Polansky. (2016, May 27). Notes on Cho-Am: The Myth of Closure [Blog post]. Retrieved November 13, 2017, from http://sufficientlyhuman.com/archives/1432.
7. Mindflex (2009). Board game. El Segundo, CA: Mattel.
8. Author. (2016). *Brief Excursion*. USA: Author.
9. György Buzsáki. (2006). *Rhythms of the brain*. New York: Oxford University Press. Retrieved November 15, 2017, from https://neurophysics.ucsd.edu/courses/physics_171/Buzsaki%20G.%20Rhythms%20of%20the%20brain.pdf, 240-2.
10. Author. (2016). *Thinning*. USA: Author.
11. Oliver Sacks. (1999). *Awakenings* (1st Vintage Books ed). New York: Vintage Books, 76.
12. Kevin Nelson. (2012). *The spiritual doorway in the brain: a neurologist's search for the God experience*. New York: Plume, 227-8.
13. V. S.Ramachandran & Sandra Blakeslee. (1999). *Phantoms in the brain: probing the mysteries of the human mind* (1st Quill ed). New York: Quill, 247.
14. Author. (in preparation). *Desert Mother*. USA: Author.
15. V. S.Ramachandran & Sandra Blakeslee. (1999). *Phantoms in the brain: probing the mysteries of the human mind* (1st Quill ed). New York: Quill, 251.
16. Daniel Paul Schreber, (2000). *Memoirs of my nervous illness*. New York: New York Review Books, 265.
17. Walter Pahnke. (1969). The Psychedelic Mystical Experience in the Human Encounter with Death. *Harvard Theological Review*, *62*(1), 2–21. Retrieved from http://csp.org/docs/PahnkeIngersoll1969.pdf, 5.

Author Biography

The author is a game designer and new media artist whose primary interest is in game rules as an expressive medium. His video and interactive work has exhibited in festivals and galleries in New York, Johannesburg, São Paulo and Los Angeles, including SIGGRAPH, A MAZE. International Games and Playful Media Festival, and FILE Electronic Language International Festival. His work has been written about in Kill Screen, Baltimore City Paper, and Rock, Paper, Shotgun.

Proposal ISEA 2018

Dr Tracey M Benson | Josiah Jordan

This paper / installation explores a project-in-progress titled *Waters of the Past*. The project has emerged from residencies in the Faroe Islands, Iceland, New Zealand and Norway in 2016-17. The paper specifically addresses a sub-project which has emerged from the larger body of work - *Journey of the Ancients*, which is a collaboration between Tracey Benson and Josiah Jordan.

The project explores the iconography of the sea and natural environment as a juxtaposition to ancient runic symbols. These symbols represent a culture and language lost as well as a ‘proxy’ for ancestral links to the old country.

The first stage of the work took the form of a video installation featuring an audio composition created by Josiah using Tracey's DNA. The raw DNA data was translated into MIDI notes and assigned instrumentation for each chromosome relevant to Tracey’s Norse ancestry. The resulting composition connects the audience to this ancestral link, while providing an abstract space for contemplation.

Documentation of *Walking with the Ancients*, DNA Music Video Installation, Balance Unbalance, Plymouth UK 2017 © Tracey M Benson

Josiah and Tracey started to work together after the SCANZ Te Mahia residency in New Zealand in February 2017. They identified many synergies between their interests and were both seeking to create AR and VR works that had the potential to be meditative, hopeful and connected to nature.

Journey of the Ancients seeks to create a meditative space for audiences, one that takes them on a journey to the inner world of deep contemplation. Although the material is a reference to Tracey's ancestral connections to Norse culture, the imagery and sounds are intended to evoke connection much more broadly.

The use of the Runes is both as a means to connect ancient knowledge but also as a pathway to greater earth awareness. Each of the 24 runes from the Elder Futhark responds to an aspect of nature - both the natural world and our human nature. Each one offers the opportunity to consider ways to acknowledge and respect the elements and limitations of that nature.

Rune journey: Messages from the shore
Found objects, stones carved with shell
Korpúlfsstaðir, Iceland, 2016

Journey of the Ancients is now evolving into a VR experience which will combine the DNA music with the Runes to create an interactive experience for audiences.

So far our project has been presented at a number of forums: Balance UnBalance 2017, Plymouth UK; RIXC Open Fields 2017, Riga Latvia and as guided meditation at Kulturehuset Hovtun 2017, Klokkarstua, Norway.

Documentation of *The Call: Crawick Multiverse*, Scotland, September 2017
Multi-site outdoor performance, Led by Katharine Vega
Photograph by Michelle Proksell

About the artists

Tracey Benson

Tracey Benson is an artist, social scientist and researcher based in Canberra. She focuses on issues related to wellbeing, sustainability behaviour change, energy futures and water. She explores a range of media including open data, augmented and virtual reality, often collaborating with cultural owners and scientists. Tracey is also a part-time academic at the Faculty of Art and Design and a Professional Associate of the Institute of Applied Ecology at University of Canberra. Tracey has a PhD from ANU and is currently undertaking a Masters of Applied Science by Research at the Institute of Applied Ecology.

Josiah Jordan

Josiah Jordan started his career as an aerospace engineer, designing and building a space-bound solar imaging camera at the Laboratory for Atmospheric and Space Physics in Boulder, Colorado. After 3 years in aerospace he switched paths to software development, creating virtual aircraft configuration software for the Boeing 787 Dreamliner. Moving to New Zealand in 2009, he most recently was focused on creating cloud-based scalable render farms and a rich web application platform for the Internet of Things space. He now owns and operate Lobaki, a company specializing in teaching VR development to at-risk youth, and creating commercial VR experiences. In his spare time he collaborates on artistic projects, with a focus on DNA music and VR experiences.

Ecological Aesthetics

Artful tactics for humans, nature, and politics

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Abstract

Stories that think and change; stories that deconstruct and distill; stories that make and provoke new stories, new pasts, presents, and potentials – all felt and thought, both affectively, and upon reflection.

Introduction

My new book, *Ecological Aesthetics: artful tactics for humans, nature, and politics* (Dartmouth College Press, to be released 3 July 2018) reminds us that stories are simple, but precious – and, perhaps, a bit too rare in current critical discourses. And they are the "artful tactic" with which I propose we mostly orient ourselves towards concern with the world: with humans, nature, and politics, with how we move-think-feel and act. I give in-depth narratives around about ten artists and their artworks, over ten sections, like a gentle manifesto, moving between strong statement and rich description, thoughtful definitions and punctuated rhythms.

An "ecological approach" takes account of agents, processes, thoughts, and relations. Humans and non-humans, matter and concepts, things and not-yet things, politics, technology, economics, and industry, for example, are all actively shaped in, and as, their interrelation. And "aesthetics" is five things: what can be said, shown, experienced, or practiced; what is said, shown, experienced, or practiced; how it is said, shown, experienced, or practiced; why it is said, shown, experienced, or practiced; and, most importantly, the stakes therein. It is, overall, a style of, and orientation towards, thought, and thus action.

For ISEA, I am proposing a paper and roundtable / panel discussion with four of the artists / art collectives I write about in this forthcoming book, to explore new forms of media-based art activism, which have us encounter a politics of generosity and beauty in the everyday, through stories, friendships, protests, walks, and other relationship-forms that cultivate looking, seeing, feeling, acting, and change.

Milwaukee's Overpass Light Brigade in action

For example, Durban-based, Mauritian-born artist and architect Doung Anwar Jahangeer's failed attempt at suicide resulted in a new life of walking and talking, teaching and learning, between his habitat and communities. Inspired by Michel de Certeau's "Walking in the City" (1984b), Jahangeer continues this book's argument in showing us the difference between tactics and strategies, and the importance of vulnerability in the everyday. He takes interested parties on long walks around Zululand, and his politically charged but always generous artwork is literally an experience and practice of movement, a relation to others and their/our environments. Jahangeer points out what he calls the "organic intelligence" of cities, society, nature: emerging ecologies.

Or, former ISEA Co-Director Malcolm Levy makes prints and videos that are reminiscent of glitch art, which purposefully makes use of errors in media storage and/or playback formats as part of its aesthetic, most often inviting an experience of media's materiality, and/or our relationships to its concepts and forms. This artist's works present what happens when we accent how contemporary electronic sensors move and think and feel and break—at least in terms of what we have come to want and expect from today's consumer-based, "postinternet" technologies. Postinternet does not mean "after" the internet, but rather after its incorporation into the everyday: art and aesthetics that address the World Wide Web's (and broader contemporary technology's) effects on culture, society, and dialog.

a Doung Anwar Jahangeer *City Walk*

It is often talked about alongside the "new aesthetic," which refers to the increasing use of machine and digital ("new" media) images and forms in our physical and aesthetic world. Glitch, drone videos, augmented reality, surveillance, and GPS-generated maps and views are all examples of the new "born digital" aesthetic. Levy and his materials, processes, and images challenge the standard narratives we tell each other about computers—what they are, and do, and afford—and gift us with new ones, and thus new possibilities. Here we engage with Richard Grusin's "Radical Mediation" and Jussi Parikka's Anthrobscene to speculate on, wonder about, and move around those human constraints we thrust upon our machines, with microcontrol. What are their unseen impacts and ethical implications? Levy's other-frames bring to the fore the materiality of digital information, and images, and tools, and the inherent politics of how we make and relate to them.

The Overpass Light Brigade turns left-leaning Twitter sound bites into collaborative, physical messages that light up bridges for drivers and pedestrians to reflect on, or participate in. We will discuss how the team brings together individuals, each holding one lit-up alphanumeric character, to display changing activist messages on highways and at rallies. Theirs is a community of practice, a ripple effect of connections always a part of, and making, bodies, texts, meanings, policies, stories. This section pieces together Jean-Luc Nancy's being-with of matter and people and things, and simultaneously exhibits the ecological connections of many (and implicitly all) contemporary activist practices.

one of Malcolm Levy's *Other-frames*

Sean Slemon's *Goods for Me*

Finally, we will go on to contrast aesthetic versus ethical approaches to life and decision-making. South African-born and New York-based artist and teacher Sean Slemon produced *Goods for Me* (2011) and other tree-based works, where he pulls, breaks, or cuts down each of a tree's components—large and small leaves, various-sized branches, the trunk and roots—and compartmentalizes them into individual frames, like a cabinet of curiosities. These sculptural installations, which also house live bugs and ongoing decomposition, articulate nature and culture as continuously moving—and thus changing—together, and over varying timescales. Here we have an immediately felt experience—what Alfred North Whitehead calls "self-enjoyment" (1968: 150) and Eduardo Kohn calls an "aesthetic of the immediate" (2002: 70)—which also has us "concern" ourselves with the before and after, with the outside that both made for this occasion of experience, and where, with our help, it might be heading afterward (Whitehead 1968: 167). Overall, style and aesthetics, wonder and beauty, can have us think-with, and thus aim toward, a better future.

The everyday notion of representation could mean "to depict," or "to present again" (re-present), but Jean-Luc Nancy asserts that the "re- of the word representation is not repetitive but intensive . . . mental or intellectual representation is not foremost a copy of the thing," but an intensified presentation. It is "a presence that is presented" (Nancy 2007: 36; emphasis in original). The re- in represent is, in other words, an amplification; to represent is to present more of what is. Thinking further still, re-presenting could refer to the potency in and of the present. Here we move-think-feel with our present, and all the things (actions, objects, entities, and time itself) that led to this moment and encounter, all the things (conceptual, material, temporal, and otherwise) that might unfold from now. The present, and all that it is, is always more, is always present in its own fullness, and present as the things past and things to come; it can and should always be felt, both ecologically and aesthetically. To re-present in this way is to present our present (and more) as a presence.

Every aesthetic orientation is an ethical one, and vice versa. This panel is an experience and a practice, a call for experiences and practices, that takes account of aesthetics, ecologically (and ethically). And it ultimately asks us to do precisely this. Tell stories. Yours, each other's, the world's; tell stories of the things that matter.

Ecological Aesthetics (the book) and this panel are not about art – at least not exclusively. They ask us to continuously think- and act-with the world and its inhabitants, both human and nonhuman; to orient ourselves in ways that we might find and express what our environments, and what they are made of, want; and then to decisively help and continue those thoughts, wants, and actions along their way. More on the book project at http://ecologicalaesthetics.net; it's available via for pre-order Amazon at http://amzn.to/2lyREAk

Author(s) Biography(ies)

Nathaniel Stern < http://nathanielstern.com >is an artist and writer, Fulbright and NSF grantee and professor, interventionist and public citizen. He has produced and collaborated on projects ranging from ecological, participatory, and online interventions, interactive, immersive, and mixed reality environments, to prints, sculptures, videos, performances, and hybrid forms. His first book, Interactive Art and Embodiment: The Implicit Body as Performance (Gylphi 2013), takes a close look at the stakes for interactive and digital art, and Ecological Aesthetics: artful tactics for humans, nature, and politics (Dartmouth 2018) is a creative and scholarly collection of stories about art, artists, and their materials, which argues that ecology, aesthetics, and ethics are inherently interconnected, and together act as the cornerstone for all contemporary arts practices."Technological, thought-provoking and unexpected" (NPR) Stern has been dubbed one of Milwaukee's "avant-garde" (Journal Sentinel), called "an interesting and prolific fixture" (Artthrob) behind many "multimedia experiments" (Time.com), "accessible and abstract simultaneously" (Art and Electronic Media web site), someone "with starry, starry eyes" (Wired.com) who "makes an obscene amount of work in an obscene amount of ways" (Bad at Sports) – both "bizarre and beautiful" (Gizmodo). According to Cory Doctorow at Boing Boing, Stern makes "beautiful, glitched out art-images," and Caleb A. Scharf at Scientific American says Stern's art is "tremendous fun," and "fascinating" in how it is "investigating the possibilities of human interaction and art." Stern is an Associate Professor of Art and Design in Peck School of the Arts at the University of Wisconsin – Milwaukee, and a Research Associate at the Research Centre, Faculty of Art, Design and Architecture, University of Johannesburg.

References

Bateson, Gregory. 1979. *Mind and nature: A necessarunity*. New York: Dutton.

Bateson, Gregory. 1972. *Steps to an Ecology of Mind: Collected Essays in Anthropology, Psychiatry, Evolution, and Epistemology*. United Kingdom: Intertext.

Bennett, Jane. *Vibrant matter: A political ecology of things*. USA: Duke University Press, 2010.

Boetzkes, Amanda. 2010. *The ethics of earth art.* United States: University of Minnesota Press, 2010.

Cubitt, Sean. "Electric Light and Electricity." *Theory, Culture & Society* 30, No. 7-8 (2013): 309–323.

Cubitt, Sean. 2016. *Finite Media: Environmental Implications of Digital Technologies*. United States: Duke University Press.

Editor, Machine Wildneress exhibition catalog. Albuquerque: ISEA, 2012

Guattari, Felix, Dgenosko Gary, and Ian Pindar. *The Three Ecologies.* United Kingdom: Distributed in the United States by Transaction Publishers, 2000 (1989).

Grusin, Richard. "Radical Mediation." *Critical Inquiry* Vol. 42, No. 1 (Autumn 2015): 124-148.

Grusin, Richard. *Premediation: Affect and Mediality After 9/11*. United Kingdom: Palgrave Macmillan, 2010.

Kohn, Eduardo. *How Forests Think: Toward an Anthropology beyond the Human*. United States: University of California Press, 2013.

Kohn, Eduardo. *Natural engagements and ecological aesthetics among the Ávila Runa of Amazon Ecuador.* Madison (2002): University of Wisconsin. http://zoologia.puce.edu.ec/vertebrados/Recursos/publicaciones/Cientifica/Kohndissertation2002.pdf

Manning, Erin and Brian Massumi. 2014. *Thought in the Act: Passages in the Ecology of Experience*. United States: University of Minnesota Press.

Massumi, Brian. 2002. *Parables for the Virtual: movement, affect, sensation.* United States: Duke University Press.

Massumi, Brian. 2015. *Politics of Affect.* Cambridge: Polity Press.

Massumi, Brian. 2011. *Semblance and event: Activist philosophy and the occurrent arts*. Cambridge: MIT press.

Massumi, Brian. 2014. *What Animals Teach Us About Politics.* United States: Duke University Press.

Nancy, Jean-Luc. 2007. *The Ground of the Image.* New York: Fordham University Press.

Parikka, Jussi. *Geology of Media.* United States: University of Minnesota Press, 2015.

Shaviro, Steven. 2010. "Self-Enjoyment and Concern: On Whitehead and Levinas." In *Beyond Metaphysics?: Explorations in Alfred North Whitehead's Late Thought.*, edited by Roland Faber,

Stern, Nathaniel. *Interactive Art and Embodiment: The Implicit as Performance,* London: Gylphi Limited, 2013.

Stern, Nathaniel. *Ecological Aesthetics: artful tactics for humans, nature, and politics.* New York: Dartmouth College Press, University Press of New England, 2018.

Stoppani, Antonio. "First Period of the Anthropozoic Era," trans. Valeria Federeighi, ed. Etienne Turpin and Valeria Federeghi. In *Making the Geologic Now: Responses to the Material Conditions of Contemporary Life*, ed. Elizabeth Ellsworth and Jamie Kruse. New York: Punctum, 2013.

Weisman, Alan. T*he World Without Us.* New York: Macmillan, 2008.

Whitehead, Alfred North. 1968. *Modes of Thought.* New York: Free Press.

Ecstatic Space

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Abstract

The paper presents the concept of ecstatic space based on the author's earlier practice-led research exploring a marriage between digital technologies and ecstatic technologies of *kut*, a Korean shamanic ritual exerting a significant influence on the culture, art, and psyche of Korea. Ecstatic space is inspired by *kut*; it is the immersive and transitional space where is being given the potential of atmospheric change by the *kut* performer's imagination and ecstatic technologies. This paper initially offers an alternative perspective to understand techniques of ecstasy by highlighting "spatial ecstasy" of *kut* rather than "ecstatic trance" of shamans. Subsequently, the paper examines how the ecstatic space of *kut* is conceptually connected to virtual space of digital practices, discovering similarities and differences between them. Shedding new light on ecstatic space, this will open the way for future development of ecstatic space in the contemporary milieu.

Keywords

Kut (Korean shamanic rituals), ecstatic space, techniques of ecstasy, digital performance, virtual reality, transitional atmospheres.

Ecstatic space

Figure 1. *Interactive digital ritual, Miyeoji-bangdui, with a virtu al soul of the dancer moving according to the shimbang's chant,* 2015, The Creative Center for Convergence Culture, Seoul, © Haein Song.

Ecstatic Space is the space inspired by *kut*, also spelt *gut* (KOR. 굿), a Korean shamanic ritual which exerts a significant influence on the culture, art, and psyche of Korea. With the development of Shamanism studies, *kut* has been known as the practice of *shimbang* (or *mudang*)[1], a Korean shaman who performs a professional role by linking a variety of invisible beings and the human as a liminal being. When a *kut* is held, an everyday place is changed into *kutp'an*, a temporary stage of *kut* decorated with a variety of divine installations. Then, people enter *kutp'an* to experience shamanic rituals including playing music, singing, dancing, chanting, reciting mythical stories, consuming ritual wine and food and performing spirit-possession rituals.

Kut is assumed to have about a 5000-year-old history with evidence of prehistoric rock paintings in Korea[2]. Although ancient Korean shamanism had a strong power as a primitive religion, *shimbang* and *kut* have long been suppressed as superstition due to the influx of other religions

[1] Korean shamans are referred to as different names by the regions such as *shimbang* in Jeju Province, *Mudang* in Kyeongsang Provinces and *Tangol* in Jeolla Provinces (Yang 1988: 21). Although the term, *mudang,* is used most often in Korean shamanism to refer to Korean shaman, this paper uses the term *shimbang* because this research is done in Jeju area with Jeju shamans. *Kut* is performed not only by *shimbang* but also by professional *kut* performers whose ritual performances aim to bring happiness, heal the sick, and comfort the souls.

[2] The images of dancing shamans in *Baugudae* Rock Art (Namgung 2001: 133) as well as the several shamanic elements in *Cheojeonri* Rock Art also reveal that a *shimbang* existed in the middle of Neolithic Age or the Bronze Age (Chang, 2014: 61-62).

and the Japanese colonial policy to obliterate Korean culture (Jo 1997: 106–09). The reason that *kut* could still survive as a cultural influence in South Korea today, despite the political and religious oppression, is probably because of people's needs of *kut* to cope with the material and spiritual matters of a progressive modern society.

According to a master *shimbang*, Soon Sil Seo, one of the most significant purposes of *kut* is healing: she proposes that *kut* has played a role of what a mental hospital is doing today, solving the unfathomable personal, family, or social pains. The curing power of *kut* takes an integrated and embodied approach to mind, body and spirit due to the *shimbang's* belief that an imbalance of the mind and body or a disharmony with spirits causes the problems of our life. *Kut* can be identified as a sort of Dionysian festival of Korea that allows people to play outside of class and status.
Even in pre-modern Korean society where the idea of Elders first and androcentrism was predominant, *kut* retained equal rights and opportunities for everyone to enjoy rituals with the belief that all souls are equally important regardless of the taxonomic classification as well as the social status of real life (Kim 2009). Making people and souls vent anger, regrets, and sorrows through comforting and delighting rituals, *Kut* has been in charge of healing the psychological illness and wishing good luck to the community.

This moves us on to the question: what is the primary *kut* technique that causes the healing effect? In shamanism studies, 'the technique of ecstasy' has been raised by numerous shamanism scholars as one of the most significant elements for therapeutic efficacy (Chae 2010; Cho 2012; Eliade 1972; Kim & Choi 2013; Pratt 2007; Sorgenfrei 2010). This ecstasy has been mainly expounded in the context of the ability of the shaman (or *shimbang*), rather than that of *kut* (or shamanic rituals) in shamanism studies, ever since Mircea Eliade defined a shaman as the great master of ecstasy (Eliade 1972: 4). Eliade's *Shamanism: Archaic Techniques of Ecstasy* is regarded as the classic book of the shamanism study (Pratt, 2007: xi), opening up the different understandings on shamanism for European scholars who read shamans as a mentally deranged, disturbed and certifiable person (Cho 2012: 452-453). Eliade defines ecstasy as one of the fundamental techniques of a shaman, which always contains a trance – "a temporary abandonment of the body by the soul of the shaman" (153), or "losing one's soul" or "losing consciousness" that travels through the sky and the land by a soul leaving his or her body (154).

However, Eliade's interpretation of ecstasy seems insufficient to provide a clear ontological criterion of defining Korean shamans and *kut* since it barely corresponds to *the* techniques *of shimbang*. The soul of *shimbang* does not have a journey, but its body is possessed by, or cohabits with other spirits or supernatural beings at will to communicate with them (Lim 2006: 76–77). Instead of losing their consciousness, *shimbang* becomes a placatory counsellor or translator who delivers the words of spirits to help them to communicate with people or vice versa (Walraven 2008: 243). More importantly, the trance or possession is not a prerequisite for every *shimbang*. In fact, a majority of Korean shamans are *Sesup-mu* (hereditary shaman) who do not appear to have the spiritual ability but comfort spirits and people through their highly-trained dances, songs and drums. Consequently, confusion arises due to the different forms of ecstasy. As Eliade argues, if the spiritual ability of the shaman – "Spirit Journey"– is the essence of the techniques of ecstasy, we can deductively assume that a *shimbang* without spiritual ability is no longer a shaman, and the *kut* that is not controlled by spiritual power is no longer a *kut*. This shaman-centred definition of ecstasy provides a lack of theoretical dimensions to interpret *kut* and *shimbang*.

Therefore, my research project explores the "spatial ecstasy" of *kut* rather than "ecstatic trance" of the shaman to offer an alternative perspective to understand the *technique of ecstasy*. In detail, when we go back to the root of "ecstasy", it comes from the Greek *ekstasis,* meaning "standing outside yourself" (Cresswell 2009). Eliade points out the soul journey of the shaman as the ecstatic technique because the shaman's soul is, in fact, travelling outside of oneself. However, in a broadened sense, it can be interpreted as the mental state that people feel, as if they are standing on one side of their world. Consequently, the state when people feel like they are stepping into the alternative reality escaping from their ordinary routine is the starting point to reach the ecstatic state. Given this, the ecstasy technique can be regarded as a sort of technology that lets people stand in another form of surroundings, which is different from the ordinary everyday life that they are accustomed to.

Figure 2. *Miyeoji-bangdui*, with *shimbang*, having a cleansing ritual for the virtual souls of the performer, 2015, The Creative Center for Convergence Culture, Seoul. ©Haein Song.

Regarding this, it can thus be suggested that *kut* is an art that can impart a certain ambience of the space through the ecstatic technology. *Kut* is designed to trigger the performers to cross the threshold between consciousness and unconsciousness via a deep immersion, while *shimbang* is a

master artist who can sincerely expose what they feel and imagine at the full immersion state. The movements of *shimbang* expressed through *kut* influence the tone, energy or ambience of the space, which help people to drift into the spiritual realm of *kut* and to temporarily exist there, separate from the material world. *Shimbang* sometimes evokes spatial hallucination in the ecstatic state. Whirling around the space faster and faster with a reverberating sound of gongs, the *shimbang* seems to be floating in the air, and the

stage feels like revolving around her. The purpose of this spatial ecstasy would be a spiritual, personal or communal healing; providing a place where people experience another atmosphere which enables them to think, retrospect, be happy or sad, laugh, and enjoy themselves together.

In this paper, the term 'ecstatic space' has come to be used to refer to the transitional space triggered by this spatial ecstasy – the space which is being influenced by the power of *kut* performers' imagination and ecstatic technologies, thereby being given the potential of atmospheric transformations. The focus of the ecstasy technology is thus creating the ecstatic space for people rather than presenting the ecstatic power of *shimbang*. This carries the significant overtones that the *shimbang's* ability is dependent not only on how strong their spiritual powers are but also on how well they guide people to be engaged with and enjoy the world of *kut* through their dancing and singing rituals. This might be the reason why there are two types of *kut* performers in Korea, those who have remarkable artistic skills and those who possess a divine power.

Ecstatic technologies & digital technologies

Figure 3. *Immersive performance ritual, NEO-KUT, with the shimbang dancing in the kime -space created by the projection lights*Cent Song.er , 2016, At Artaud Performance the Center, Ltitle ondon, © Haeinon

the

If the ecstatic techniques of *kut* serve as a vehicle for accessing the mythical worlds of *shimbang* beyond the ordinary life, current digital technologies appear to offer a modern approach for accessing the digital world. Czechborn philosopher and media theorist Vilém Flusser addresses the utopian view of digital technology as promising a 'new ontology' or 'new anthropology' in the digital age with respect to art. He asserts that people in previous ages tried to gain control over the given world (*datum*) through technologies, but now, with digital media, people can artificially produce the world (*factum*) with their imagination, becoming artists. For him, a computer is a medium that begins to make this change because it is not merely a machine but the device that can analyse, synthesise and thus create artificial spaces and beings (Flusser 1996: 242-243). Flusser claims that 'we are no longer the objects of a given objective world but project the alternate world' (244), and he identifies us as a projection, arising from the submissive position of subjection. Relating to Flusser's consideration of the artistic life of the future that people project their world through the combination of technologies and imaginations, Roy Ascott, one of the most important British artists in the field of cybernetics and telematics, claims that artists today could challenge and re-form our concept of reality through up-to-date digital technology. According to Ascott, digital technology currently performs a similar role to that fulfilled by shamans. For example, people can explore "double consciousness" standing between the virtual and material space, aided by computation technologies, as shamans enter the "trance" through their shamanic rituals (Ascott 2003: 357-358). Additionally, Ascott notes that people today can experience not one reality, but "three VRs" through interactive digital technology[3]. This projected reality offers the user a kind of mediated experience that has never before existed.

The ecstatic space and the virtual space seem conceptually analogous to each other since they are presenting the mediated world. While *shimbang* create their liminal world by projecting their mythical imagination applying ecstatic technologies, today's digital practitioners build the alternative reality by drawing their imagination into reality through digital technologies. In addition, there is something in both virtual space and ecstatic space that forms a sense of in-between-ness. While digitally mediated world produces a liminal sense, generated between the digital imagery and live users (Dixon 2007: 337), *kut* continues to explore the boundaries between consciousness and unconsciousness, or the visible and invisible worlds. Furthermore, *kut*'s ecstatic technology is paralleled to digital technology in that they both attribute to develop the presence for accessing the mediated world – a sense of being in the mediated world which is temporary or spatially remote from our real world. As the development of digital technologies contributes to the sensorial richness of the virtual world by increasing the vividness and interactivity of the virtual environments, that of ecstatic technologies offers the *shimbang* and *kut* performers to offer more detailed and sophisticated sense of perceiving the mythical world.

These interesting resemblances have inspired me to discover the conjunction between the ecstatic and digital technologies. As a *kut* performer, I am genuinely interested in the organic and analogue side of creating the mediated environments as in *kut*. Yet I am also intrigued to discover how the digital computation technologies can enhance what I can do with my own hands. Thus, my practice-led research strives towards the use of interactive digital visuals within *kut* to evoke the same mythical world of imagination which,

[3] The three VRs including: 1) virtual reality through interactive digital technology; 2) validated reality through reactive mechanical technology; 3) vegetal reality through psychoactive plant technology (Ascott 2011).

until now, has relied on more ancient tools – paper, bamboo, natural lights, colour coding and fabric.

However, my practices focus on exploring the ritual way of applying digital technologies to conjure the ecstasy space. It is because there are some differences in perception of the mediated environment between the virtual and ecstatic space. Most virtual realities are perceived based on visual or auditory messages. Accordingly, our cognition tends to read these audio-visual messages of virtual space and direct our consciousness to experience virtual reality. This process of perception seems to make it difficult to have embodied experiences. It may be the case that a participant who wears goggles to enter virtual reality easily loses his or her kinaesthetic control and wiggle in the space relying solely on audio-visual information. The virtual facility we enjoy to watch, listen, communicate and control is likely assisting the breakdown of the perceived need for direct human experience since it is based on a one-to-one connection between the message generated by a computer and a participant.

In contrast, the ecstatic space is usually experienced by the connection between *kut* performers (or *mudang*) and guests (or participants). As the ritual dance of bees informs other bees of the distance, direction, and amount of food, the collective movement of rituals becomes a message exploring the internal domain of ecstatic space. In my view, the performers are the ones who have the gift of kinaesthetic sensitivity to explore the unknown and unconscious realm by immersing themselves in the ecstatic space through embodied experiences. As their ritual movements guide the guest to enter the journey of *kut*, the movements become the message or messenger of the ecstatic space. In this manner, the digital or analogue audio-visual images act as a poetic or totemic element to support the exploration of the movements, which does not play as much of a subjective role as it does in virtual reality. Therefore, peoples' cognition is not applied for directing their experiences, but being aware of their spontaneous consciousness (or unconsciousness) for more visceral experiences.

Although digital technology has spawned whole new species of entertainment and communication products, which become a medium potentially more connected to today's audience than previous technologies used in the *kut,* the way of discovering the virtual world seems to accelerate the erosion of embodied and communal experiences provided by the collective experiences of *kut*. As *kut* has provided a needed antidote to loneliness and depression as well as many other increasingly common social ills, I believe that today's digital technology toward the ecstatic space might provide people with healing, communal, and embodied experiences along with more sophisticated and vivid virtual environments.

Figure 4. *NEO-KUT*, the guests participating the ritual of the threshold by holding together the long fabric symbolizing *dari*, a spiritual bridge. At Artaud Performance Center, London, 2016. © Haein Song.

As a result, my practice pursues the ecstatic space exploring a marriage between digital and ecstatic technologies. The ecstatic space is the immersive and transitional space where is being given the potential of atmospheric change by the *kut* performer's imagination and ecstatic technologies. It is also a kinaesthetically perceived space that can be conjured by the message of the movements within the ritual. In order to combine digital and ecstatic technologies, I have identified the *kut's* ecstasy technology according to its principal design features of the space, *mugu* (Shamanic User Interface), and rituals of *kut,* and connected them with digital technology. The series of practices explores with *kut* performers and *shimbang* regarding how digital images are expressed as a shamanic medium. By linking digital technologies directly to ritual sounds, voice, instruments, and body movements, my research attempts to steer the control of this new medium towards the meaningful evocation of the ecstatic space, and thereby deliver the beauty of the world beyond in which humanity is bathed but unaware of.

References

Ascott, R. (2003) *Telematic Embrace: Visionary Theories of Art, Technology, and Consciousness.* London: University of California Press.

Ascott, R. (2011) 'Moistmedia, Technoetics and the Three VRs,' Retrieved May 9, 2016, from Hz-Journal, http://www.hzjournal.org/n16/ascott.html.

Chae, H. (2010) The Meaning of Shinmyung and the Generative Time-Space. *Korean Aesthetics*, *9*(2), 53–77.

Chang, M. (2014) The religion and the shape of the rite represented on the Cheonjeon-ri Seoseok Petroglyphs, *The study of Korea Petroglyphs,* 18(0), 47–79.

Cho, H. (2008) *The History and phenomenon of Korean MU.* Honolulu: University of Hawaii Press.

Cho, H. (2012). *ubanp'ungnyuji (*又半風流誌*) - shinmyŏng*. Seoul: Hanyang university.

Cresswell, J. (2009). ecstasy. "Oxford University Press." https://doi.org/10.1093/acref/9780199547920.013.1748

Dixon, S. (2007). *Digital Performance: History of New Media in Theater, Dance, Performance Art, and Installation*. *The MIT press*. London, Cambridge.

Eliade, M. (1972). *Shamanism: Archaic Techniques of Ecstasy*. (R. T. Willard, Ed.). Princeton: Princeton University Press.

Flusser, V. (1996). Digital Apparition. In T. Druckrey (Ed.), *Electronic Culture: Technology and Visual Representation* (pp. 242–245). New York: Aperture.

Howard, Keith (1998) Korean Shamanism today, *Korean Shamanism, Revivals, Survivals, and change*, (pp. 1–15). Seoul: The Royal Asiatic Society Korea Branch.

Kim, K. (2009). *The introduction of Korean philosophy: the creation and change of philosophy Korea*. Seoul: Dongbang Media. Retrieved from http://www.riss.kr/link?id=N11809548

Kim, M.-H., & Choi, C.-Y. (2013). An Ontological Interpretation of Animal Dance and the Experience of Ecstasy in Shamanistic Exorcism. *The Korean Research Journal of Dance Documentation*, *28*(1), 1–20.

Lim, J.-H. (2006). A thinking of study for Gut culture History and an extension of Historical Recognition Area. *Korean Shamanism*, *11*(3), 67–146.

Moon, M.-B., & Moon, B. (2011). *The Report of Jeju Keun-gut*. Jeju-si: KBS.

Namgung, Il (2001) A study on formative aesthetic shown from petroglyph, *The study of Visual Design*, 8(0), 125-140.

Pratt, C. (2007). *An encyclopedia of shamanism*. New York: The Rosen Publishing Group, Inc.

Sorgenfrei, C. F. (2010). Case Study: Korean shamanism and the power of speech. In *Theatre histories: an introduction* (pp. 45–51).

Walraven, B. C. . (2008). *Korean Shamanism*. *Numen* (Vol. 30). Honolulu: University of Hawaii Press.

Yang, Jongsung (1988) Korean Shamanism: The Training Process of Charismatic Mudang, *Folklore Forum*, 21(1), 20– 40.

The Sangamine-Ecohouse

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Keywords

self-sufficiency, renewable energy, workshops, counterculture, coexistence, The Whole Earth Catalog, cybernetics

Abstract

This is a comprehensive initiative that includes: the construction of a self-built house on the premises of Aichi University of the Arts in Nagakute City in Aichi Prefecture; the use of renewable energy with this house being the central point; the growing of vegetables on a natural farm; workshops where regional citizens get to have experiences with nature; the creation of an informational network for regional citizens; and the creation of festivals that allow for exchanges between regional citizens. In the 1960s, cyberculture arose from the counterculture movement, and the Internet and personal computers started to be developed. Even now, this has grown into smartphones, the Internet, and renewable energy. The abilities of individuals are being cybernetically expanded, and the networks have pushed the human spirit beyond the physical form. Also, the current era is moving towards the dream of coexistence that could not be accomplished by the counter culture in the 1960s. This project is creating connections between citizens in the same region by leveraging its self-sufficient spirit and using the power of music, art, and networks, and it is bringing back a traditional lifestyle that coexists with nature.

Background

Around 2007 when the plan to construct a self-built house was started, there was a close-up view of environmental problems like global warming. Additionally, in Japan, the destruction of nature and deforestation had become a problem. Therefore, we thought that we would like to get to know more about the current state of the forest and the surrounding natural environment by building a house ourselves. Moreover, because problems with farm chemicals and food issues had risen to the surface, we started a workshop together with the regional citizens to allow people to have natural experiences including farming within the region and university. Furthermore, around this time, high-speed fiber optic Internet lines were connected, and it became possible to always be connected to the Internet. Also, smartphones and SNS started to spread, and it became possible to communicate through the Internet anywhere in the world even outdoors. In this situation, we felt that the field of our activities was in the process of going beyond being indoors and in cities and starting to include the community and outdoor areas. On the other hand, there was a flood of reproducible information on the Internet, and we started to think about the value of the actions and experiences that we can only have here that cannot be copied. Also, in Japan society was in the process of becoming sealed off and far less transparent as technology and society became more complex as issues like falsified production sites for food and falsified construction strength came to light. Therefore, we thought that we would like to get safe food and buildings that gave us piece of mind by building a house ourselves and growing our own vegetables. Additionally, the growth of cell phones, SNS, and smartphones has lessened actual face-to-face communication, so we thought we could create an opportunity to communicate with students and people in the region through the joint work of building a house and farming. Moreover, the separation of one's work from one's residence in the modern age means that the houses that people live in and the places where they work are in separate places. Thus, local communities are in the process of disappearing. Accordingly, we felt that we wanted to make this house open to the community and have it be a place where local people can have a variety of exchanges and do various activities.

The construction process

The construction process for this house is listed below.

There was a field trip to see the state of the forest and a survey done in November of 2008. The Asahi Lumber Cooperative in Asahichō area of Toyota City in Aichi Prefecture was visited, and we asked them about the state of the forest, how to distinguish cedar trees from cypress trees, and large drying machines. (Figure-1)

Figure-1, doing a survey at the Asahi Lumber Cooperative

Brining in the lumber: In November 2008, the lumber was brought in by Teiichi Suzuki from the Asahi Lumber Cooperative. (Figure-2)

Figure 2, brining in the lumber

Removing the bark: In December 2008, the bark that was on the logs was shaved off with a saw blade, and then the trees were cleared from the site where we planned to build the house.
Provisional assembly: In December 2008, the carpenter Mr. Tsuge carved mortices into the lumber and checked that they would fit together by temporarily assembling them.
Groundbreaking ceremony: In December 2008, the area where the house would be built was enclosed in hemp rope in light rain, and vegetables, alcohol, rice, kelp and fruits were offered up inside this space. Then a service was held for the groundbreaking ceremony. A total of 12 people participated in the ceremony. (Figure-3)

Figure 3, the groundbreaking ceremony

Yarikata: In December 2008, the area around site that was planned for the construction by the carpenter Mr. Tsuge was surrounded by boards, and the position where the house would be built was decided.
Constructing the foundation: In December 2008, the land was surveyed, and 8 self-supporting foundations were built. Voids (cardboard tubes) were buried in the ground, and concrete was poured into them. Then the pillars were carried in by hand. Lumber that has just been cut down that is still wet inside is very heavy. (Figure-4)

Figure 4, carrying in the lumber by hand

Erecting the pillars: In December 2008, teams that made a three pronged fork for each of the pillars were formed, and the pillars were held up vertically, and once they were stood up, they were made perpendicular to the foundations and installed on it. This work is normally all done using heavy machinery, and doing it by hand is difficult but fun. (Figure-5)

Figure 5, erecting the pillars

Placing the lumber for the roof on top of the pillars: In December 2008, after 8 of the pillars had been erected, the work of placing the lumber for the roof on top of the pillars was done. Ropes were tied to the lumber, and it was raised up by hand. Everyone lifted up the lumber, and the lumber was assembled by being inserted into the mortices. (Figure-6)

Figure 6, placing the lumber for the roof on top of the pillars

Each time a piece of lumber was put up, it was met with applause and cheers. The first stage was completed after the 4 pieces of lumber that would support the roof were placed on the pillars. Next the heaviest pieces of lumber that was 4.3 meters long were lifted up. The work that we had thought we would do in 2 days was almost completely finished in a single day, and the work was completed while everyone felt a comfortable sense of exhaustion. (Figure-7)

Figure 7, the completed structure of the pillars and roof

After this from 2009-2010, a wooden deck and railing were built. (Figure-8)

Figure 8, the completed structure of the pillars and roof

In 2011, the walls, doors, and windows were built, and the house was almost completed. (Figure-9)

Figure 9, building the walls

Along with the building of the house, grains and vegetables were cultivated at the natural farm. The house was used as a place to store farm tools and equipment and to dry and store the vegetables that were cultivated at the natural farm. Additionally, the house that was built was also used to hold workshops and as a storehouse for the equipment needed for these workshops. The aim was to have a self-sufficient lifestyle in a remote mountain area that is rooted in the Japan's natural ecosystem by building this house, holding these natural experience workshops, and doing this natural farming. (Figure-10, 11)

Figure 10, conducting a natural experience workshop for children in the region on the house's wooden deck

Figure 11, practicing natural farming

Setbacks for self-sufficiency, creating a network, and festivals

However, the productivity of the natural farm is low, and it requires an excessive amount of labor. So it was not able to produce the expected results. At this time, we were faced with the Great East Japan Earthquake of 2011. When this happened, the victims helped each other out while looking at their own survival, and they felt the importance of the connections within the regional community. Additionally, the tsunami caused the Fukushima Daiichi Nuclear Plant accident, and this contaminated a lot of land and crops with radiation. This made us keenly aware of the importance of a life that has local farms and a natural environment. Therefore, in 2014 we created the grass roots network called "the portal site for farming lifestyles, Nagakute Yuimaaru". This started creating a network for a life based on farms. (Figure-12)

Figure 12, portal site for farming lifestyles, Nagakute Yuimaaru

Moreover, we thought that we wanted to create a place where people can build face-to-face relationships, and the regional residents can get to know each other better. In 2014, we started the regional festival called the "Nagukute picnic," and it has been regularly held since then. The house that was built is at the center of this festival, and the festival features songs, dances, a cooking workshop, an introduction of civic activities, the sale of produce, and exhibitions of art. (Figure-13, 14, 15)

Figure 13, a live performance at the house at the "Nagakute picnic," and the performers are Pochi & Olive, TOPA

Figure 14, students introduce the activities at the Nagakute picnic

Figure 15, an exhibition being held in the house, the Nagakute art festival, the Imo group

Additionally, the experience of being forced to conserve power for a while because of the Fukushima Daiichi Nuclear accident taught us to fear reliance on large energy systems like nuclear power. The house was fitted with wind generators, solar panels, a storage battery, and a tank to collect rain water. The electricity created by these things is used for the amplification during the festival, the lights for the exhibition, and to pump rain water into farm. (Figure-16, 17, 18)

Figure 16, the house with solar panels and a wind generator

Figure 17, the house with rain water tank

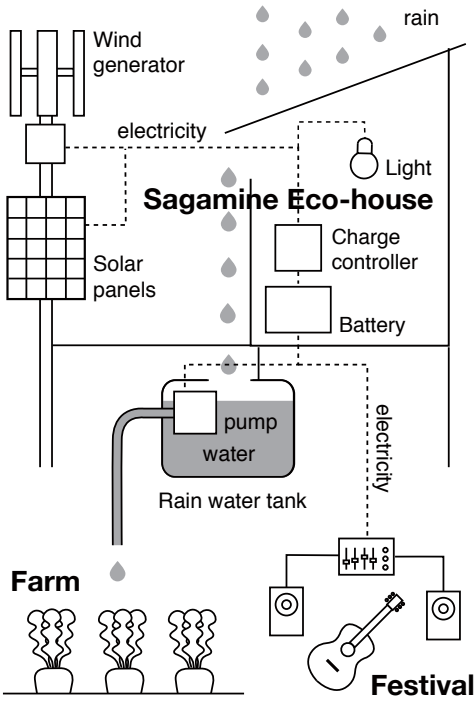

Figure 18, how the power and rain water in the house is used

The counter culture and self-sufficiency

At the beginning of this project, we aimed to have a self-sufficient life through building a house and natural farm, and this was impacted by the communal lives that were led by the counter culture in the 1960s. In the 1950s through the 1960s, people were terrified of the possibility of a nuclear war under the cold US-Soviet cold war system. Moreover, in the 1960s young Americans were conscripted to go to the Vietnam War through the draft system, and there were anti-establishment movements like anti-war demonstrations that took place all over the world. On the other hand, there were also young people who left cities who were part of groups like communes that started farming or building houses to explore a new lifestyle that was free from the oppression of the system.

The biggest legacy of the counter culture that was produced in this manner is the self-sufficient state of mind. The founder of The Whole Earth Catalog Stewart Brand made a statement to the following effect.

"There is a book called "from Counterculture to Cyberculture". If you read this book, the hippies' ethics and the philosophy were taken over by the computer culture. This book writes that the internet and web have a large impact on culture. It goes on to state that the great thing that the hippies produced was the do it yourself approach. This approach seemed to say you can do anything, and now it is found in the maker movement, the Burning Man movement, and the enthusiasm for creativity that can be seen all over the internet." [1]

The Whole Earth Catalog and Cybernetics

The young counter-culture generation in the 1960s-70s needed to escape the oppression of the system and gain the tools needed to live independently. One tool used to do this was The Whole Earth Catalog that shared a variety of tools, information, knowledge and ideas for this purpose. This was a magazine aimed at young people in the counter culture, and it published a lot of necessary information and products for the things that they were aiming to do like starting and maintaining a new commune and expanding consciousness. All of this information and these products were treated as "tools" to support their own lives.

Furthermore, The Whole Earth Catalog was not simply a catalog, it was "information technology." Steve Jobs, the founder of Apple, made the following statement about The Whole Earth Catalog.

"When I was young, there was an amazing publication called The Whole Earth Catalog, which was one of the bibles of my generation.... It was sort of like Google in paperback form, 35 years before Google came along. It was idealistic and overflowing with neat tools and great notions." [2]

Moreover, The Whole Earth Catalog had reviews of a variety of tools, and the reviews were not only done by specialists and submissions by the readers were emphasized. The receivers and senders of the information were placed on equal footing. The Whole Earth Catalog was created based on Gregory Bateson's ideas about cybernetics, and it was a place to do social experiments using a system's theory approach that emphasizes feedback. The Whole Earth Catalog viewed information as a process, and it was a dynamic setting that had a type of network forum. It was not merely ideals, and it also employed realism like a scientific approach and looking at realistic solutions to problems.

The linguistic root for cybernetics is the Greek word Κυβερνήτης that means a person who takes the rudder of a ship. This person controls the ship to advance it to its destination while it is being impacted by waves and the wind. Cybernetics is like this in that is a term that indicates constantly predicting or getting feedback about the results of an action that is taken to achieve a goal and preparing the next action. It indicates doing the best action to achieve a goal. Organisms and machines both gather information from the outside world, and have special devices in place that make this useful for their own actions. These devices change information to new forms and incorporate it so that this is useful for subsequent actions. By doing this, they are able to act in a way that is effective in dealing with the outside world. Then, the actions they actually take in relation to the outside world provide these devices with more information. In this way, both organisms and machines can control themselves and take the best actions to accomplish a goal while having a interactive relationship with the outside world. In this sense, cybernetics is a universal concept that applies to machines, natural ecosystems, information networks, and society.

The Whole Earth Catalog functioned as cybernetic information technology using a paper medium in a time when there was not yet internet or personal computers.

"Brand's vision was to turn the catalog itself into a tool. The CATALOG—he usually spelled it in capital letters—was to form a feedback loop. He wanted it to be a communication device that connected the far-

flung community he cared so much about. He wanted the catalog to be part of something that would create an equilibrium. The catalog was part of a whole system, a dynamic and self-regulating system."[3]

The Whole Earth Catalog was trying to be a whole self-regulating system that had informational and behavioral feedback loops, and it was not something that was done unilaterally by a single person. However, in the 1970s, the Vietnam War ended, and energy issues, environmental problems, pollution, and recession from the oil crisis were serious problems. At the same time, the 1970s intense counter culture movement came to a conclusion, and the communes disintegrated.

In the work "From Counterculture to Cyberculture," Fred Turner described this age in the following manner.

"Self-sufficiency is an idea which has done more harm than good. On close conceptual examination it is flawed at the root. More importantly, it works badly in practice. Anyone who has actually tried to live in total self-sufficiency-there must be now thousands in the recent wave that we (culpa!) helped inspire-knows the mind-numbing labor and loneliness and frustration and real marginless hazard that goes with the attempt. It is a kind of hysteria.... ... self-sufficiency is not to be had on any terms, ever. It is a charming woodsy extension of the fatal American mania for privacy.... It is a damned lie. There is no dissectable self. Ever since there were two organisms life has been a matter of co-evolution, life growing ever more richly on life.... We can ask what kinds of dependency we prefer, but that's our only choice." [4]

Thus, the counterculture in the 1960s-70s and the subsequent communes made by young people disintegrated, and they were not able to realize a self-sufficient coexisting lifestyle. They returned to cities and engaged in economic activities, and the dream of the counter culture disappeared. This was because they did not have realistic "tools" to live independently from society at that time. The Whole Earth Catalog finished playing its role, and its ideals were taken over by the electronic network Whole Earth 'Lectronic Link (WELL). The cyberculture was born out of this series of movements, and since then, a variety of realistic tools have been developed.

First, the personal computer was developed in the 1970s as a "tool to expand individual's abilities," and these came into common usage in the 1990s. The internet was developed as a "tool to create networks." In 1969, ARPANET connected a non-governmental internet, and in 1989, the internet browsers and www came about. In 1993, mosaic was developed, and after this, Netscape and Internet Explorer were developed. Since the 1990s, the internet has become a common tool. Later, search engines like Yahoo and Google and SNS like Facebook, Twitter, Instagram, and YouTube and smartphones became widespread. A lot of progress was made in the using the internet on personal information devices.

Now, wind generators, solar panels, electric cars, IoT and AI are in the process of becoming widespread, and "real social tools" are being developed for transportation, energy, and society. Openly shared objects, information and energy are continually advancing, and the concepts openness, sharing, and sociality that only a little while ago were concepts of the cyberworld are becoming more general in real society. (Figure-19)

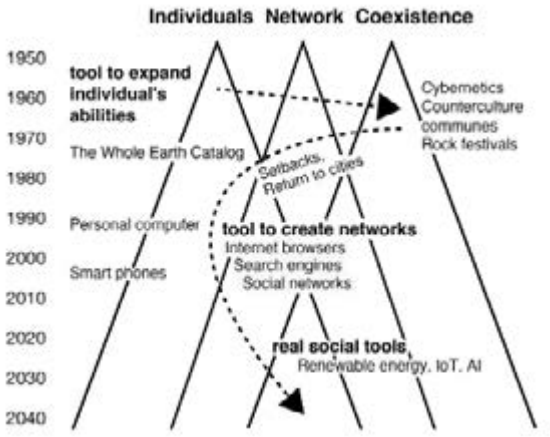

Figure 19, history of developing "tools"

From the Counterculture to the Cyberculture and coexistence

The counterculture movement faced temporary setbacks, but Bateson's ideas about cybernetics, and the ideals expressed by The Whole Earth Catalog were passed down while a variety of tools were developed. It seems like the history that has happened since the 1960s has been trying to transform society. This project tried to find a lifestyle that was self-sufficient and removed from society, but it faced setbacks. Thus, the shift to interacting with society through exchange events and creating networks in society might have been its natural destination.

People cannot live outside of society in being separated and opposed to it. Bateson realized this.

"Bateson's vision clearly echoed the New Communalist critique of technocracy. Like the former commune dwellers, Bateson offered a new consciousness as an alternative to the destructive, mechanistic forces of bureaucratic America. Yet he did not call for the establishment of alternative communities. For Bateson, mind was simply present in all social and natural relations. To recognize that immanence and to act in accord with it (and thereby possibly save the world from ecological disaster), individuals need not join an alternative community; they could simply work to influence whatever local "system" in which they found themselves involved. In this way, Bateson offered a generation that had set out for the woods fully believing that they could save the world a chance to make their way back with their faith in their own importance still intact. Although the individual could not stand outside the "system," Bateson's epistemology implied, he or she could save the system from within." [5]

Building a house, doing natural farming, and then transitioning to rebuilding society by creating a farming lifestyle network and holding festivals for people in the regional community seems like it emulates the path that was taken by the counterculture after the 1960s. However, the difference between the 60s and now is that now it is possible to use a variety of "tools" that were not available then. Now we can independently build a house, create a website, and use smartphones to communicate

over SNSs. It is also possible to generate electricity using renewable energy and hold festivals, and it has become possible to actually do a variety of things in society.

The following graph is the changes in the amount that the "Portal site for a farming lifestyle, Nagakute Yuima aru," and the site has been accessed more since its inception. This is thought to be because there is incessant access from local residents as this site displays a list of blog information diffused by them through the RSS feed, enabling one to consult the latest information of local residents on a constant basis. This could also be considered an example of a cybernetic feedback loop. (Figure-20)

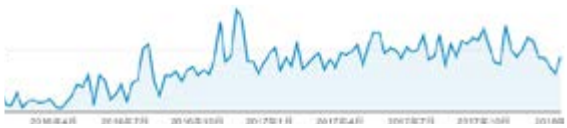

Figure 20, change in the access to the Portal site for a farming lifestyle, Nagakute Yuima aru

The regional festival "Nagakute picnic" has musical performances, music workshops, introduces participant activities, sells regional produce and handmade goods, and exhibits art. Through these things, it is attempting to create an informational and material feedback loop in real-life society. The organizers are not one-sidedly giving things to the participants, and it seems like the participants themselves are creating a self-regulating cybernetic system where they feel actively involved and have exchanges and convey information.

A Coexisting Society and the Current State of Japan

In modern Japan, society is rapidly aging due to the declining birthrate, and the budget for welfare, nursing, and education are becoming inadequate. It is becoming impossible to rely only on administrative systems. Additionally, the fact that we cannot rely solely on administrative systems when there is a disaster is a lesson that the Great East Japan Earthquake taught us. Therefore, the spirit of self-help and mutual assistance with others is necessary in addition to disaster plans and a welfare system. For this reason as well, it is important to have self-sufficiency and a do it yourself mentality where we build our lives ourselves and create networks and have exchanges with regional residents ourselves. This is not living outside of social systems in isolation from and opposition to society, and it is important to try to implement realistic solutions to social problems within social systems.

Furthermore, Bateson also referenced the role of art.

"But in the making he must necessarily relax that arrogance in favor of a creative experience in which his conscious mind plays only a small part. We might say that in creative art man must experience himself—his total self—as a cybernetic model." [6]

People who see art or listen to music or participate in these things can feel like they are part of society. Additionally, art and music are also tools for non-verbal communication that intuitively expand consciousness. They are even tools that allow people to overcome their ego and share awareness.

We are currently in the process of moving from vertically integrated unified informational, social and energy systems to pluralistically equally distributed informational, social and energy systems, and this is creating a new awareness around the world.

Jeremy Rifkin made the following statement.

"We come to see our common lot. Sharing the renewable energies of the Earth in collaborative commons that span entire continents can't help but create a new sense of species identity. This dawning awareness of interconnectivity and biosphere embeddedness is already giving birth to a new dream of quality of life, especially among the youth of the world. The American dream, long held as the gold standard for aspiring people everywhere, is squarely ensconced in the Enlightenment tradition, with its emphasis on the pursuit of material self-interest, autonomy, and independence. Quality of life, however, speaks to a new vision of the future—one based on collaborative interest, connectivity, and interdependence. We come to realize that true freedom is not found in being unbeholden to others and an island to oneself but, rather, in deep participation with others. If freedom is the optimization of one's life, it is measured in the richness and diversity of one's experiences and the strength of one's social bonds. A more solitary existence is a life less lived. The dream of quality of life can only be collectively experienced. It is impossible to enjoy a quality of life in isolation and by excluding others. Achieving a quality of life requires active participation by everyone in the life of the community and a deep sense of responsibility by every member to ensure that no one is left behind.

The new understanding of the workings of feedback loops in ecological networks is paralleled in the modeling of info-energy feedback networks in an emerging Third Industrial Revolution economy. If technology, like art, imitates life, the new networked infrastructure of the TIR economy comes more and more to imitate the workings of the natural ecosystems of the planet. Creating economic, social, and political relationships that mimic the biological relationships of the ecosystems of the Earth is a critical first step in re-embedding our species into the fabric of the larger communities of life in which we dwell." [7]

Furthermore, it must not be forgotten that this project was done at a university and that it was done with student participation. Rifkin made the following statement about education:

"The distributed and collaborative perspective starts with the assumption that learning is always a deeply social experience. We learn by participation. While our conventional education encourages the notion that learning is a private experience, in reality, "thinking occurs as much among as within individuals." Although we all enjoy moments of private reflection, even then, the substance of our thoughts is ultimately connected, in one way or another, to our former shared experiences with others, from which we internalize shared meanings.

The new education reformers emphasize breaking down the walls and engaging diverse others in more distributed and collaborative learning communities, both in virtual and real space." [8]

Conclusion

Nature originally has a cybernetic self-regulating environment in and of itself, and it seems like people who lived traditional lives while coexisting with nature understood that natural cybernetics is dispensed by nature. This seems like why they would live so close to nature. Now, in the modern age, the informational and energy systems have grown into cybernetic systems, and it seems like we have finally caught up nature and traditional living. Accordingly, nature and traditional lifestyles and energy technology are not concepts that are in opposition. Because they have the same cybernetic behaviors, it seems like they should start to have an affinity for each other.

This project aims to create a self-regulating cybernetic mechanism for the integrated whole of nature, natural living, virtual network space, energy, and reality. It will also use the power of art and music to connect regional citizens using the spirit of self-sufficiency, and going forward, we would like to pursue quality of life though things like welfare, a way of living in harmony with nature, farming, food, traditional living and a way of life that has local roots.

Acknowledgements

I would like to express my sincerest gratitude to the following people who were involved in this project: Wataru Ichiyanagi (Ichiyanagi Architectural Design Office) , eco-planning and students.

References

1. Brand, S. (2014). Special interview. *Spactator*, *30*. 70
2. Jobs, S. (2005). Stanford University commencement address. Retrieved from https://news.stanford.edu/2005/06/14/jobs-061505/
3. Lid, T. (2016). *Rise of the Machines: A Cybernetic History*. SCRIBE. 171
4. Turner, F. (2006). *From Counterculture to Cyberculture*. THE UNIVERSITY OF CHICAGO PRESS. 121
5. Turner, F. (2006). *From Counterculture to Cyberculture*. THE UNIVERSITY OF CHICAGO PRESS. 124
6. Bateson, G. *Steps to an Ecology of Mind*. THE UNIVERSITY OF CHICAGO PRESS. 444
7. Rifkin, J. (2011). *The Third Industrial Revolution*. palgrave macmillan. 221
8. Rifkin, J. (2011). *The Third Industrial Revolution*. palgrave macmillan. 242

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Urban Cyborganics: Engendering Sympoietic Experiences through Body-worn Digital Artifacts in a Rewilded City

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Abstract

Loss of biodiversity is posing an immense threat to the ecosystem, in particular the drastic decline in insect population endangers both the natural food-chain and crop production. In response to this development many cities have started rewilding efforts, aimed at increasing biodiversity. In this paper, I introduce and discuss the Urban Cyborganics project, which makes these nonhuman urban spaces available to human perception and experience through sensing technology, online connectivity and haptic output. As a speculative design project, the Cyborganic concept presents a fictitious nature-human-machine hybrid, deployed as a form of material and experiential storytelling. Leaning on Haraway's notion of sympoeisis, i.e becoming-with and making-kin, the device emulates an insect-like perception of the urban landscape, prompting a change in perception of the city space and promotes a reevaluation of how we align ourselves with other species in a built habitat. Building on Fernandez- Armesto and Ingold, I discuss the act of creation, of both cities and artifacts, as an ongoing negotiation between humans and the material agencies embedded in the environment. Lastly, I examine the Cyborganic in relation to traditional and indigenous practices.

Keywords

Insects, Cyborganics, Urban Space, Speculative Design, Craft, Nonhumans, Sympoieis, Wearables, Biodiversity, Digital-Material Story Telling.

Introduction

Insect decline has been in the public focus for some time, in particular massive honey-bee colony collapses. [1, 2] According to a recent German study, the general insect population has dropped by 75% over the last three decades. The loss of insect diversity and abundance poses a severe threat to the ecosystem as insects play a vital part in its maintenance as pollinators, food source, predators and decomposers. The cause of the decline is not clear, however the authors behind the German study suspect industrial scale use of pesticides constituting the main factor, supported by loss of habitat and to a lesser extend climatic changes. [3]

As a response to the loss of insect diversity in Aarhus, Denmark, a number of sites throughout the city are being rewilded in an initiative between the city council and the Natural History Museum. [4] In this paper, I describe an ongoing project, Urban Cyborganics, which engages in alternative forms of material storytelling around biodiversity and the rewilded, feral city. In a series of walks, human participants are asked to wear a device that can sense proximity to these rewilded sites.

The device, shown in figure 1, encapsulates the head and reacts to sites of favorable conditions for insect-life with a rattling and vibrating sound. The handwoven artifact is a design fiction where technology is used to transgress boundaries between human and nonhuman, digital and craft, and notions of natural and artificial environments.

The project extends beyond the physical artifact with an online presence and an audiovisual teaser, which can be viewed here: www.frankjaer.de/cyborganics/.

Fig 1. *The Bamboo Whisper, © author.*

Research Approach and Structure of the Paper

In this paper, I describe an ongoing speculative design project, Urban Cyborganics, as a form of applied digital-material storytelling. The encounters generated through the design artifact generates new perspectives of the urban landscape and its nonhuman inhabitants. I present and analyze the cyborganic artifact, its process of creation, and the interactions fostered between rewilded city spaces and the human wearers of the devices in the city of Aarhus, in western Denmark.

Thereafter, I position the Urban Cyborganics project

in relation to Donna Haraway's call for engaging in acts of sympoieisis and kin-making across species boundaries, followed by a discussion of the act of creation in relation to both artifacts and cities, as an ongoing process of human negotiation with materials and environments. Lastly, I examine the relationship between the cyborganic device and traditional and indigenous ritual practices.

Related Work

The Poetic-Kinaesthetic Interface project by Wilde and Underwood, uses handcrafted appendages to "provoke shifts in attitudes and viewpoints around notions of body-typical, ability and disability" by giving the wearer "the experience of moving in someone else's body, with the associated abilities and constraints." [5]

The Eyes of the Animal by Marshmallow Laser Feast, is a Virtual Reality(VR) based art project, which allows the wearer of an oculus rift headset embedded in a full-head helmet to experience a piece of woodland through the eyes of a mosquito, a dragonfly, a frog or an owl. The visual interpretation of the animals' experience of their environment is complimented by a binaural soundscape using audio forest recordings and a vibrating backpack, simulating the movement of the animal. The installation is situated in the forest itself, i.e. the VR experience is haptically and visually embedded in a real environment. The footage and soundtracks can be accessed online on the project website. [6]

The Flora Luma by Frankjaer and Kitel, is a light-object fashioned of a handwoven fibre-optic fabric. The fabric can be illuminated and is connected to a plant controlling the animation of the multicolored light inside the fabric through the variance of its emitted electrical signal. As plants are sensitive to touch, humans can interact with the plants, receiving immediate visual feedback of the plants' response, "discovering plants as sentient beings through a first-hand experience." [7]

MyConnect by Spačal, Švagelj and Podgornik consists of a human-sized pod fitted with an aray of petridishes filled with mycelium and a berth. The mycelium, like plants and animals, uses electrical signalling to communicate between different parts of itself. In the MyConnect, the heartbeat signal of a person lying on the berth is transferred to the mycelium, which in turn generates a temporal offset, that is transferred back to the human body via sound, light and haptic impulses. [8] The MyConnect and the Flora Luma, are devices that engender experiences of 'the other' by allowing humans to interact with other species, in a way that is accessible to the human senses. The Poetic-Kinaesthetic Interface and The Eyes of the Animal, akin to the bamboo headdress used in the Urban Cyborganics project, explore 'otherness', whether human or nonhuman through immersive experiences emulating its target subject's sensory perception and to an extent its physical abilities.

Characteristic to all these projects are their sympoietic nature, i.e. they are 'acts of becoming-with' as their primary function is to facilitate experiences of human or nonhuman others, as a way to build relationships and engender empathy. Urban Cyborganics extends on this work by incorporating the built environment into the sympoietic experience. I expand on the cyborganic and sympoietic notions in the following section.

Urban Cyborganics

Cyborganics

The cyborganic is a design fiction from the field of tangible and body-worn digital artifacts. The term cyborganic conjoins the notion of the cyborg with the organic to create a fictional character, transcending human, nature, machine boundaries. The term cyborg is short for "cybernetic organism" and was introduced by Clynes and Kline in their 1960 paper *Cyborgs and space,* arguing for enhancing humans with bio-mechatronic body parts to adapt them to life in outer space as a more viable option for extraterrestrial colonization than providing an earthly environment to the space traveler. Hence adding the 'anic' to cyborg may at first glance seem superfluous as 'organism' is already contained within the term. However, though closely related organic has a different meaning than organism, an organism is an organic entity, a life form. Something organic is of or relating to an organism, whereas organic matter is matter that has come from a once-living organism, is capable of decay or the product of decay, or is composed of organic compounds. [9] In common usage organic refers to agricultural produce that has been grown or raised without the use of artificial fertilizers and pest control and is related to environmentalism. Cybernetics, which is commonly taken to denote digital technology – prefix anything by the word 'cyber' and it is embedded within the internet – actually refers to how a system controls itself and communicates with other systems. The term was originally introduced by Wiener in 1948 as "the scientific study of control and communication in the animal and the machine" and regards any system as self-regulatory and closed, i.e. as autopoietic. [10, 11] Disapproving the perception of living organisms as autopoietic, Dempster introduces the term 'sympoietic' as a better way to conceptualize complex living systems, which are characterized by permeability and boundarylessness. [12] Haraway defines sympoiesis as "thinking beyond individualism into relationships by fostering relations and making kin with 'all kinds', both human and nonhuman." [13]

It should at this point be noted that as a design fiction, the device is not truly cyborganic, i.e. implanted into the human body, but emulates a cyborganic experience.

Sympoietic Devices

In her 2016 book, *Staying with trouble: making kin in the Chtulhucene,* Donna Haraway encourages engagement in sympoietic acts, i.e. becoming-with in kin-making processes across species boundaries, to address the ongoing environmental destruction. She calls for storytelling for collective world making, i.e. telling speculative stories transforming our sense of the possible. Whilst Haraway acknowledges the usefulness of the Anthropocene for gathering the arts, humanities, and social sciences around environmental questions, with the notion of the Chuthulucene, she moves beyond problem diagnostics and embraces the human as a technoscientic fabulist, that must learn to tell stories that strengthen ecological response-ability. [14] Together with the examples presented in the Related Work section, we position the cyborganic as a sympoietic device, a design fiction, which enables a form of digital-material storytelling, transforming its wearer's sense of self to become-with and make-kin with all the unacknowledged companion species that make up our life-world. In Haraways' view companion species are anything that makes human existence possible, ranging from gut-bacteria to rice, mice and cows. [15]

The Bamboo Whisper

The cyborganic project grew out of a series of material experimentations during a workshop on haptic interfaces as a collaborative exploration of how traditional crafts, organic materials and digital technology could blend and augment the human body. During the creative process, we allowed the materials to "take the lead" in an open-ended process, where the material agencies and emerging properties as computational composites are seen as co-designers in the design process. [16, 17]

From these explorations emerged the Bamboo Whisper, a bonnet-like headpiece woven from bamboo reeds and dried grasses. In its initial application, it explored the kineaesthetic experience of a human 'other' in a pair of devices, where voice input is translated into percussive rhythm of a second device as is shown in figure 2.

The strong insect-like qualities of the devices, in particular the emitted rattling sound, evocative of a stridulating insect, but also the encapsulating rigidity, reminiscent of an exoskeleton led us to redesign the functionality of the Bamboo Whisper to explore insects and insect being. We were interested in insects "in the wild" and initially envisioned some kind of sensing equipment connecting with activities in a hives.

However, the vast majority of insects are singular and do not live in hives. In addition, as insects are generally very small, their emissions, i.e. sound and vibration are practically impossible to capture in an open environment with numerous other sources generating similar data.

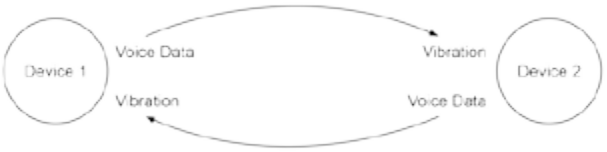

Figure 2. *Function diagram Bamboo Whisper version 1.*

We therefore chose a different approach and emulated insect response to its environment, by querying an array of meteorological conditions through an online weather service, as well as using local sensor data to establish conditions as favorable or unfavorable to insect activity, as listed in figure 3. In case of favorable conditions, the device responds to areas of high biodiversity, indicating increased insect activity, detected through the inbuilt GPS, as shown in figure 4.

Weather conditions	**Favorable**
Precipitation	Less than 2mm within last hour
Wind	Less than 7 m/s
Temperature	Above 12°C in spring and autumn, 18°C in summer

Figure 3. *Weather conditions table.*

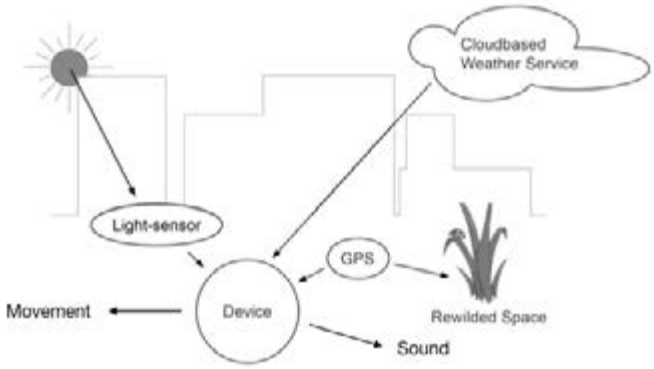

Figure 4. *Function diagram Bamboo Whisper version 2.*

Cyborganic Aarhus

In Aarhus, the Rethink Urban Habitat project led by the Natural History Museum has 42 rewilded sites scattered around the small city in western Denmark. The initiatives range from actively building structures to aid biodiversity, so-called "insect-hotels", the greening of fountains and even a cow-pasture, to simply refraining from tending and cutting back wild growth in certain areas. Additionally, several citizen-led greening and rewilding initiatives have been initiated, many of them undocumented. The Bamboo Whisper device responds to these areas when in close proximity, i.e. it 'awakens' when discovering space habitable to insects and gets 'excited' as it gets closer. In a preliminary study, two

volunteers, walked a two-kilometer route encountering 6 sites of biodiversity, shown in figure 5. The cyborganic walkers were later interviewed about their experience which they described as having a different perspective of both the city and their own bodies, whilst conjuring associations of crickets and other insects. The walkers were neither instructed into the functionality of the devices beforehand nor about the conceptual reasoning behind the project.

Figure 5. *Cyborganic Walkers in Aarhus, © author.*

Liminality and being-other

Traditional and indigenous cultures know about the deep value of 'becoming-other', often in rites of passage, such as the Ulwaluko carried out by the South African Xhosa. Homecoming initiates carry a reed crown when returning from their month long secluded stay in the bush, where they are stripped of both their clothing and their identity to become men. [18] Concealment often plays and important role, the Xhosa boys are covered in white clay and wrapped in blankets and in Malawi Yao boys wear reed outfits during the rites, as seen in figure 6, similar to the raffia grass worn by female Ngbende initiates in the northern Congo, which includes a grass fringe covering their faces. The grass conceals the juvenile identity of the initiate until the ritual is complete and she is reborn as a woman. [19] The transitional stage in these rituals is marked by liminality, a condition of ambiguity or disorientation, where the initiates are in-between identities. "Liminal entities are neither here nor there; they are betwixt and between the positions assigned and arrayed by law, custom, convention, and ceremonial" (sic). [20 p.95] Hybrids, such as cyborgs are equally liminal beings, characterized by being neither one or the other of its kind. Other kinds of hybrids such as the American shamans, have the ability to shapeshift, i.e. enter animal forms, a skill shared by their bronze-age counter parts who lived just south of today's Aarhus.

Molting, the act of metamorphosing into another creature seen in a wide array of invertebrates, to the

Figure 6: *Malawi boys in initiation ritual, Steve Evans [CC BY 2.0 (http://creativecommons.org/licenses/by/2.0)].*

shaman means access to other worlds. Shamanism is about transcendence and in shamanistic cosmology, all living beings have the same kind of soul, whereas it is the body, which shapes the perspective through which we perceive the world.

By gaining access to other bodies, one gains access to other worlds, which enables communication between the living and dead, humans and spirits, humans and animals. [21] Similarly, the cyborganic human- machine-nature hybrid, is in a state of liminality, neither technological, nor natural, nor human, nor machine, but comprising parts of everything. The transformation is not complete, but a temporary condition, after-all the device can be removed at any time. This temporary condition, which in itself is liminal, can be likened to play, representing a surreal or 'not-quite-real' reality, where the strictures of known realities may be loosened, opening up for possibilities of reconfiguration. [22 pp.25- 26]

In western traditions, the Carnival is today associated with costumed street-parties and colorful parades, however the masked celebration which marks the beginning of Lent, was traditionally a reversal ritual, where all rules are suspended or inverted and any identity could be freely assumed. In pre-Christian times these rituals were thought to chase away the winter spirits and return the spring and the crops. [23] Nature in this view is not independent of humans but exists in a sympoietic relationship, where human actions are of utmost importance to ensure the benevolence of the earthly spirits. Much like in many African countries, when visiting the local shebeen (bar/pub) the first sip of a beer is poured on the ground to appease the ancestors. Seen from a secular point of view, these notions may easily be dismissed as superstitious and outdated, however the responsibility of the human to make space for the nonhumans in order to ensure the continuous working of the ecosystem, such as maintaining an environment that is habitable to insects, is becoming increasingly — and painfully — clear. This recognition is reflected in recent developments in various parts of the world; over the last

few years New Zealand has granted legal personhood to a national park, a river and a mountain following Maori cosmology that understands the natural environment as kin; Ecuador has granted the environment institutional rights independent of consequences to humans; and in the Swiss constitution all living beings have been granted
the right to dignity. [24-26]

Correspondingly, in academia, particularly within the humanities, there is an increasing resistance against reductionist, dualist thinking and a call for moving towards a non-anthropocentric, posthumanist worldview, including a growing interest in indigenous knowledge systems as providing informative models of living sustainably with, and in, the natural environment. [27-29]

Discussion: Decivilizing and rewilding

The Urban Cyborganics project explores cyborganic being in relation to urban space, extending from human-machine-nature into the build environment. Since the emergence of agriculture, the settlement is a paramount factor in contemporary human cultures and is one of the defining criteria of that constitutes a civilization. Etymologically the word civilized, derives from the Latin civilis, meaning civil, which is related to civis, i.e. citizen and civitas, the city. [30 p.73]

"Civilization makes its own habitat" writes Fernandez-Armesto and asserts that a civilization presents "a relationship between one species and the rest of nature, an environment refashioned to suit human uses." [31 pp. 4-5] Fernandez-Armesto's somewhat unorthodox organization of the different types of human societies by geographical categories rather than location or time-period, reflects an understanding of creation as a response to materials, as opposed to the more common hylomorphic perception ingrained in western thought.

The hylomporphic model, as introduced by Aristotle, asserts that being is comprised of two compounds, form and matter, where form is seen as pure and intentional thought, and matter as inert and passive. In this model, creation happens when form is imposed onto matter, like the architect designing a theoretical building, which is then subsequently and separately manifested, i.e. built by workers. [32] In contrast Deleuze and Guattari argue that in a world of life the essential relation is between materials and forces and not between matter and form. [33 p.377] The world is not a static abstraction reducible to simple formulas, rather "it is about the way in which materials of all sorts, energized by cosmic forces and with variable properties, mix and meld with one another in the generation of things." [32 p.92]

This view of creation as a reciprocal and fluid negotiation between maker and materials, resonates with the creative approach described in the Bamboo Whisper section, where the materials are allowed to "take the lead" in an open-ended process where material agency and the properties of the artifact are regarded as co-designers in the creative process. Breaking with the dualistic hylomorphic model, where matter is seen as an inert and passive recipient of the will of conscious and intentional (human) thought, towards accepting and embracing the agency of matter leads to a more balanced and less anthropocentric world-view more in line with indigenous animist cosmologies, such as e.g. the Maori of New Zealand described in the previous section.

In the understanding of Fernandez-Armesto, civilization is measured as proportional to the distance to the natural environment, where 'more civilized' indicates the degree of denaturing of the human and the constructed habitus, and not as a value judgement. Since the Neolithic revolution 12.000 years ago there has been an ongoing attempt to denature and domesticate humanity, culminating with the ideal of the Enlightenment, to domesticate anything which is wild or savage. [31 p.15] Most recent developments in this trajectory can be seen in the transhumanist movement which believes in transgressing the biological aspect of the human through technology, to achieve immortality and enhanced sensory capabilities, thereby effectively severing the link to the biological world. [34]

In contrast, sympoietic projects, such as Urban Cyborganics, Flora Luma, Eyes of the Animal and MyConnect, acknowledge that humans are sociotechnical beings, whilst illustrating that technology does not necessarily denature us, but can be applied as an experiential bridge and means of temporary transcendence from an overly civilized and isolated human realm, into a complex sympoietic habitat comprised of interlocking and coexisting techno-mechanical and organic systems and beings.

During the interview following the walk through Aarhus, one of the participants explained how the headdress integrated with her body, and how she had to get used to "having a different[ly] shaped head" where the restrictions imposed by the device afforded her a very different perspective of the city, whilst it during the walk became apparent that the at first random seemingly vibration, had a distinct pattern to it.

Whilst the decoding of the pattern and its triggers remained outside the participants understanding, the sound and the rattling conjured up memories of childhood camping trips and crickets in the grass. The second participant explains "we experienced the city in a different way, how we think about [the] invisible and what might be the value of the invisible and how might we give a voice to the invisible" adding that "it's also a way to maybe easier communicate to the audience as well because it's so sense-able, you know you can sense it. And it's not something we show up there [projected on a wall or screen] that's abstract. It's just so concrete." Meaning that the physical experience of wearing the device and engaging with the city through the body had a greater impact than using audiovisual material.

She adds that although there was an element of loss of control "[it] is so different from [using the] eyes and also hearing. I mean, you can close your eyes or you can turn the other way around right? But with the head-thing, you're just forced to be alert you know, you're just forced to wander around like so", referring to the restrictions imposed by the headdress, it was not intimidating. Walker one explains "the design doesn't look threatening, even if it's unfamiliar and it's not a hat I would regularly wear, it doesn't look threatening. I don't know if it's the materials or anything." Similarly, in the Poetic-Kinaesthetic Interface project, the researchers describe how handcrafting the artifacts opened up for conversations that otherwise may have been difficult to have through the inherent accessibility, non-threatening and inclusive nature of craft. Similarly, the cyborganic proposes an alternative story to the transhumanist narrative of technological augmentation of the human body, through the deployment of a handcrafted device made of organic materials.

Conclusion

Environmental issues, such as insect decline are threatening to collapse our ecosystems. In Aarhus, the city has responded to these challenges are 'de-civilizing', i.e. opening up to nature and actively rewilding the urban landscape. In this paper, I have presented a speculative design project Urban Cyborganics, consisting of a headworn device fashioned of bamboo-reeds, as sympoietic device that allows its wearer to experience the rewilded islands in the urban landscape through a nonhuman perspective. I have discussed the device and its application as part of Rewilding Aarhus, as well as its relationship to the notion of sympoieisis as introduced by Dempster and Haraway. Furthermore, I have discussed the etymological roots of cyborganics, within organics and cybernetics and related the urban cyborganics project to traditional and indigenous practices of ritually altered and liminal identities. Leaning on Fernandez-Armesto and Ingold I have then discussed creation of both cities and artifacts as constituting a continuous negotiation between humans, materials and the natural environment. Lastly, I have and discussed the cyborganic experience as rewilding and decivilizing of technology in relation to the human. As a form of material storytelling and technological fabulation, as an experiential engagement with the city and its nonhuman spaces, the Urban Cyborganic project enables an experience of the city from a nonhuman perspective, through a temporarily liminal body facilitated through the sympoietic artifact.

Acknowledgments

The Bamboo Whisper was created in collaboration with Patricia Flanagan at the Haptic Interface Workshop in Hong Kong 2014. The Cyborganics project is supported by the Human Futures Research Group, Aarhus University.

References

1. Evans, J.D., et al., *Colony collapse disorder: a descriptive study*. PloS one, 2009. **4**(8): p. e6481.
2. Neumann, P. and N.L. Carreck, *Honey bee colony losses*. 2010, Taylor & Francis.
3. Hallmann, C.A., et al., *More than 75 percent decline over 27 years in total flying insect biomass in protected areas.* PloS one, 2017. **12**(10): p. e0185809.
4. *Rethink Urban Habitats*. 2018; Available from: http://www.naturhistoriskmuseum.dk/Default.aspx?ID=2756.
5. Wilde D, Underwood J. Designing towards the Unknown: Engaging with Material and Aesthetic Uncertainty. In *Informatics* 2017 Dec 26 (Vol. 5, No. 1, p. 1). Multidisciplinary Digital Publishing Institute.
1. Feast, M.L. *In the Eyes of the Animal*. 2017 2017-06-07; Available from: http://iteota.com/.
2. Frankjaer, R., *Fostering Care and Peaceful Multispecies Coexistence with Agential Provotypes.* Proceedings of the 14th International Symposium on Electronic Art (ISEA). , 2017.
3. Spačal, S. *myconnect*. 2018; Available from: https://projectmyconnect.wordpress.com/.
4. *Definition of ORGANIC*. 2018; Available from: https://www.merriam-webster.com/dictionary/organic.
5. Wiener, N., *Cybernetics or Control and Communication in the Animal and the Machine*. Vol. 25. 1961: MIT press.
6. Varela, F.G., H.R. Maturana, and R. Uribe, *Autopoiesis: the organization of living systems, its characterization and a model.* Biosystems, 1974. **5**(4): p. 187-196.
7. Dempster, B., *Boundarylessness: introducing a systems heuristic for conceptualizing complexity.* Nature's edge: Boundary explorations in ecological theory and practice, 2007: p. 93-110.
8. Haraway, D.J., *Staying with the trouble: Making kin in the Chthulucene*. 2016: Duke University Press.
9. Haraway, D., *Anthropocene, Capitalocene, Chthulhucene. Donna Haraway in conversation with Martha Kenney.* Art in the Anthropocene: Encounters Among Aesthetics, Politics, Environment and Epistemology, 2015: p. 255-70.
10. Haraway, D.J., *The companion species manifesto: Dogs, people, and significant otherness*. Vol. 1. 2003: Prickly Paradigm Press Chicago.

11. Giaccardi, E. and E. Karana. *Foundations of materials experience: An approach for HCI*. in *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. 2015. ACM.
12. Vallgårda, A. and J. Redström. *Computational composites*. in *Proceedings of the SIGCHI conference on Human factors in computing systems*. 2007. ACM.
13. Bullock, R. *It's hard to be a man*. 2015.
14. Fisher, A.B., Carol *A female Ngbende initiate of Northern Congo wearing raffia grass, Congo*. African Ceremonies Collection 1999 [cited 2018; Available from: http://www.aluka.org/stable/10.5555/al.ch.document.bfacp1b10276.
15. Turner, V., *The ritual process: Structure and anti-structure*. 1969.
16. Varberg, J. *Shaman eller kultleder? Dansk gravhøj gemte på slangekvinde*. Forskerzonen, 2015.
17. Schrage, M., *Crafting interactions: The purpose and practice of serious play*. Teoksessa L. Valentine (toim.), Protype. Design and craft in the 21st century, 2013(s 19): p. 28.
18. Harris, M., *Claiming pagan origins for carnival: Bacchanalia, Saturnalia, and Kalends*. European Medieval Drama, 2006. **10**: p. 57-107.
19. Roy, E.A. *New Zealand gives Mount Taranaki same legal rights as a person*. 2017 2017-12-22; Available from: http://www.theguardian.com/world/2017/dec/22/new-zealand-gives-mount-taranaki-same-legal-rights-as-a-person.
20. Becker, M., *Correa, indigenous movements, and the writing of a new constitution in Ecuador*. Latin American Perspectives, 2011. **38**(1): p. 47-62.
21. Brom, F.W., *The good life of creatures with dignity some comments on the swiss expert opinion*. Journal of Agricultural and Environmental Ethics, 2000. **13**(1): p. 53-63.
22. Braidotti, R., *The posthuman*. 2011, Cambridge: Polity.
23. Berkes, F., C. Folke, and M. Gadgil, *Traditional ecological knowledge, biodiversity, resilience and sustainability*, in *Biodiversity conservation*. 1995, Springer. p. 281-299.
24. Cash, D.W., et al., *Knowledge systems for sustainable development.* Proceedings of the national academy of sciences, 2003. **100**(14): p. 8086-8091.
25. Sullivan, L.E., *The SAGE glossary of the social and behavioral sciences*. 2009: Sage.
26. Fernández-Armesto, F., *Civilizations: culture, ambition, and the transformation of nature*. 2001: Simon and Schuster.
27. Ingold, T., *The textility of making.* Cambridge Journal of Economics, 2009: p. bep042.
28. Deleuze, G. and F. Guattari, *A thousand plateaus: Capitalism and schizophrenia*. 1988: Bloomsbury Publishing.
29. More, M., *The philosophy of transhumanism*. The transhumanist reader: Classical and contemporary essays on the science, technology, and philosophy of the human future, 2013: p. 3-17.

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Raune holds an M.A. in Spatial Interaction Design and is currently a doctoral candidate in Digital Design and Information Studies at Aarhus University, Denmark. Her research on sympoietic technology centers on non-anthropocentric applications of information and communication technologies, with a particular focus on crafts, interactive digital artifacts and haptic body-worn interfaces. Her work has been presented in Germany, Denmark, Colombia, U.S., Australia and Hong Hong. Raune is the recipient of several awards, most recently the prestigious Elite Research from the Danish Ministry of Higher Education and Science.

Spaces That Perform Themselves

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Keywords
Sound, space, multi-sensory, perception, plasticity, music, architecture, human, non-human, choreography.

Abstract
As we generally experience on earth, there is no space without sound and there is no sound without space. Spaces That Perform Themselves proposes to expand the way we relate to sound and space by presenting a multi-sensory kinetic environment that morphs along with a musical piece and creates a dynamic space in constant flux. This augments our sonic perception through a cross-modal spatial choreography that combines sound, physical movement, light, color, and vibration. This project builds up a scenario to study the possible relationships between a human body and a robotic architectural body, throughout a dance/exchange of perception and matter. The objective is to challenge our static structures and by doing that, stimulate our own plasticity.

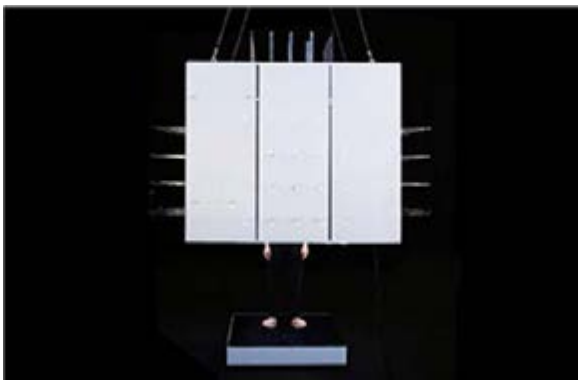

Fig 1. *The cube*, multisensory kinetic environment with human in its inside.

Introduction

The study of the relationship between sound and space, or music and architecture has been fundamental to the opening of new explorations towards the expansion and merger of both fields. In the second half of the 20th century, many creators explored this in experimental ways. Contributions such as Stockhausen's sound spatialization, La Monte Young and Marian Zazeela's Dream House, and Bernhard Leitner's sound architectures, to name a few, revealed expressiveness and malleable capacities of spatial sonic experience, as well as opening an extensive discourse around musical spaces and plastic architectures.

Cedric Price's Fun Palace proposed a cybernetic architectural system that could adapt depending on the varying necessities of individuals and its context. Today this vision is no longer considered to be a utopia, as shown in the work of researchers like Behnaz Farahi, Ruairi Glynn, Skylar Tibbits and Michael Fox, which have opened engaging possibilities to augment the interaction between humans and dynamic forms of the built environment.

Spaces That Perform Themselves continues and extends the discussion from a sonic-spatial perspective; it poses the question: how does a kinetic architectural system change the way we think about and perceive sound? One of this project's objective is to create an augmented relationship between sound and space. Currently, we generally build *static* spaces to contain *dynamic* sounds. What if we start building *dynamic* spaces to contain *dynamic* sounds? By integrating kinetic behavior as part of the performance of a space, one is able to give life to a container that morphs along with a musical piece: bringing to life an emerging aesthetic form of expression, augmenting the field of exploration that combines architecture, music, science and technology. This project seeks to explore the plasticity of the spaces we inhabit and the plasticity of our own minds. The perceptual plasticity of a room is not only related to its capacity to move, change, and evolve, but it also has to do with conquering and pushing the limits of how we relate to the environment and other non-human agents on it.

In the exploration of spatial experience and its relationship to the phenomenon of sound, it is imperative to understand how sound and space are linked: as we generally experience

on earth, there is no space without sound and sound carries the essence of the space it is embodied in. To be able to explore this further, it is necessary to have in mind notions of acoustics and acoustemology. These fields of study are essential for an optimal achievement of a sonic-spatial composition, because both reflect the constitutional relationship between sound, space, and experience. They define how the characteristics of a space will affect the way we perceive sound, derive meaning therefrom, and in turn, how the characteristics of sound will affect the perception of a space and its experience.

This project presents an environment that re-configures itself and presents a multi-sensory scenario to perceive sound. Spaces That Perform Themselves is a project that will allow music to give shape to a dynamic room that is both alive and in constant flux: it moves, changes its geometry and size, breathes, feels and responds. It is what Bruno Latour would call an Actant or an enhanced body of "Vibrant Matter", referencing Jane Bennett's vital materialistic theories. This room will take the shape of a cube that can host one individual at a time, presenting an intimate and personal experience. By creating the perception of a single space that morphs along a progression of sonic situations, this room will have the ability to become "many rooms" within the same structure. A synchronous choreography of sound, motion, vibration, light, and color will shape this perceptual experience, confounding the senses and giving the possibility of inducing different physical and psychological scenarios.

In order to understand the mediation that connects spaces to bodies, we must explore the body-and-space relationship. The notion of space that this paper will address is the uniform boundless medium where things are organized in three dimensions, thus enabling encounters between animated and in-animated bodies. A scenario that represents a regular body-and-space relationship can be typified by imagining an individual inside an architectural body, for example, a person standing inside a container composed of static walls. Due to the simplicity and familiarity of static architectural bodies, an individual in this specific situation can easily understand and predict his or her interaction within this scenario. In other words, it is not a challenging situation for her or him to experience due to our accustomed quotidian action of encountering rooms with fixed structures.

However, the individual's ability to understand and predict the body-and-space relationship becomes increasingly more complex if, in the previously mentioned scenario, the architectural body is replaced by a natural body. A natural body is an organic container that is dynamic in its essence and presents an unpredictable and ever-morphing self. When a room is constantly changing or evolving, it demands more of our attention and cognitive action to be able to understand our relationship to it and how to act/be. By encountering a dynamic room that morphs and reacts to sounds, it is possible to reconstruct the way we relate with our environment, it is possible to think about a hybridization or viscosity of the self; allowing the possibility of being natural, mechanical, fictional, real, material, and immaterial at the same time. This way, indeterminacy and uncertainty are presented as a key factor for constructing narratives of coexistence and the de-territorialization of thought. This way, this cube creates a platform for new imaginaries to defy and replace stereotypes.

The human body is placed at the inside of a body that teaches us about plasticity, resilience, adaptability, and vulnerability. And by doing this, we can understand the fragile alien condition in which we experience and relate to the world. By encountering this body, we might discover a less hierarchical and more transversal ecology, where situations of control are constantly shifting, where things can gain control and guide us on the performance of a narrative that unfolds on time; understanding this as a constant exchange between two bodies that are subjects of emergence. Spaces That Perform Themselves presents a body that is in a constant act of becoming, a body that reconfigures not only its shape, but also structures of power, and by so doing, proposing alternative forms of being. As a result, unusual possibilities are triggered challenging systems of thinking, making us aware of our bodies in an emotional relationship with space, sound and time. Critically challenging the way humans relate to other agents, as well as challenging the role of a space, which tends to be static, utilitarian, and functional, which tends to be in service of anthropocentric structures.

1. Body

1.1. Shell

The shell of this project is its architectural structure, what contains the body and also what contains the experience. The shell in this case takes the shape of a 180 x 180 cm cube that hangs from the ceiling and has no bottom, leaving an opening beneath so that a human can enter it by kneeling

down and emerging into it. The five faces of the cube feature a motorized mechanical system of rack and pinion, which engages clear acrylic rods to actuate flexible fabric walls on its inside. These walls will adopt different shapes and positions creating a malleable room. The fabric not only is the dynamic enclosure of the inside walls, but also acts as a screen to diffuse the light and color of LEDs behind it. The cube floats over a platform that vibrates, this creates a sense of physical sound that goes from your feet to your whole body.

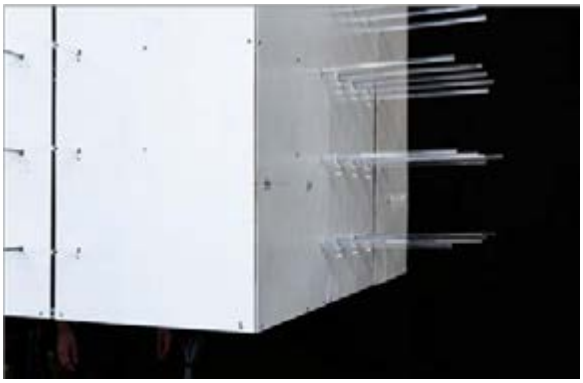

Fig 2. *Cube exterior detail*, shell and rods.

1.2. Guts

The guts of this body are constituted by four Systems that give life to this dynamic environment. First of all, the Motion/ Mechanical System that consists of all the parts that generate physical movement of the walls. There are 45 simultaneous stepper motors to actuate the fabric walls. Every motor is conceived as an individual module with its own microcontroller and address tag. They are all interconnected and controlled via I2C communication. This modular networked platform allows all the motors to act independently or simultaneously. The Sound/Vibratory System provides 5.1 high fidelity spatialized audio system. All four walls have a speaker embedded in the structure, and a fifth low frequency transducer is placed beneath the platform. This creates a controlled scenario for an embodied perception of air vibrations. The Light/Optical System consists on an array of LEDs in every wall to add the dimension of light, color, and brightness. Finally, the Sensory/Reactive System is what gives the room its interactive ability and opens the possibility of improvisation; it gives the chance of triggering changes and making every performance unique. Every wall has a capacitive touch sensor, which creates a system of 5 triggers that changes color and adds sounds.

1.3. Brain

The computational structure that brings this system to life is an interconnected set of elements that receive musical data and create different synchronized outputs. A graphical user interface (GUI) control platform is designed to present a tool primed for movement composition alongside the other aspects of the spatial choreography. This control platform communicates software - a DAW (Digital Audio Workstation) with Processing - to send synchronized data (MIDI) via serial communication. This enables the mapping of different sound/musical parameters to pre-programmed output patterns for controlling the motors and lights. The system can be either entirely reactive to the music, or controlled in real time. This opens the possibility of a mixed use, promoting further experimentation, creative processes, and customized outputs. The four Systems that determine the cube's functionality are triggered from the same software. This allows an organized and easy way for the mapping of all the elements, which facilitates the composition and creative processes.

2. Expression

2.1. Personality

Even if the cube's body is a concrete and rigid object, what constitutes its personality is light and ethereal. Donna Haraway wrote: "Our best machines are made of sunshine; they are all light and clean because they are nothing but signals, electromagnetic waves, a section of a spectrum, and these machines are eminently portable, mobile..." [1]

The cube requires the capability of being expressive to communicate, connect and engage. The musical parameters are carefully mapped to the electronic elements of the system. This opens an extensive exploration of cross-modal perception, ranging from sound and color perception, light awareness to vibrations, acoustics and space modulation. The personality of the cube is given by each one of its parts working together. To unveil this character, it is fundamental to understand the phenomenological objectives of each one of its Systems. This will give clarity of the creative possibilities and set up the context for composing.

1. Motion / Mechanical System: architectural spaces are containers of experiences and different levels of

interactions. Interactions between bodies inside of a space and bodies interacting with a space. When a room changes and is unpredictable, we need to re-map how we relate to it. This modifies our own spatial presence in a new dialectic manner. This means that the movement of the room triggers new perceptual associations and perceptual dispositions towards the room itself.

The cube embodies a dance that alters its geometry, dimensions, volume, and proximity to the human on its inside. The motion carries a direct connection with the kinesthetic sense of the cube and visual sense of the user. Humans are visual beings, often trying to understand things from a distance and observe remotely before involving touch and a state of vulnerability. "Our vision of the world is far more complex than the mere activation of the visual part of the brain. Vision is multimodal; it encompasses somatosensory, emotion-related, and motor brain networks, and this activation plays out in endochrine systems and more. (Images can make you sweat.) The observation of touch triggers the somatosensory cortex. The observation

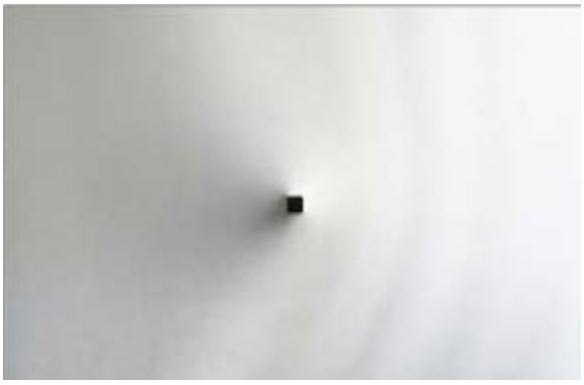

Fig 3. *Interior detail*, flexible fabric wall with capacitive touch sensor.

of the expression of emotions and feelings activate limbic and emotional-related brain regions. Motor neurons not only cause movements and actions but they also respond to body-related visual, tactile, and auditory stimuli, mapping the space around us, the objects at hand in that very same space, and the actions of others. Cortical motor networks thus define in motor terms the representational content of space, objects, and actions." [2]

Though, spatial experience is never a fragmented phenomenon; everything that rises from it comes from the combination of the diverse sensory elements around us. The human brain will react to the movement of the cube and will re-wire the way we understand and relate with spaces, creating a new perceptual model of dynamic behavior, instead of taking for granted its initial configuration as a permanent static state. Spatial recognition is usually done immediately; our brains know how to understand a space and its dimensionality; this way our bodies can be there at ease without even thinking about it. As Marvin Minsky said: "We are less aware of what our minds do best." [3]

By challenging this way of thinking, our minds will expand to include the dimension of time as part of a room's configuration. Having a room changing in a dynamic way opens the encounter of an architectural system that is designed not to accomplish a purpose, but to create an effect.

2. Sound/Vibratory System: usually, for human beings the sense of audition is less fundamental than the sense of vision or touch. Even though the sonic phenomenon is an important tool for understanding our context, dimensions, materials, and distances. Sound places us in the world. There are many theories of how sound is physical and creates a link between the material and immaterial world. This is what ties sound to an extensive discourse as a creator of material affective memory.

Sound is actually the resonance and vibration of matter, of particles of air or other materials. Within Husserlian phenomenological thinking, the material aspects of sound makes it a valuable tool of auto-affection, because it involves touch. Thus sonic phenomena is material and has spatial presence. "The most important sense in our body is touch... Hearing is linked to touch from a phylogenetic perspective (inside of the lateral line organs of a fish, destined to the reception of pressure stimuli of ultrasound, then evolved into amphibian's auditory organs, and later into our ears) and from a ontogenetic perspective (the vibrations of sound reach the fetus through the capture of the amniotic liquid's pressure over the epidermis; during the prenatal phase we can talk about a "global ear", an approach of hearing with all the skin). Thus, drawing a "haptocentric" vision of human sensitivity, where the tactile contact is the source of synesthetic associations and human being's affective
associations." [4]

Sound breaks down boundaries between material spaces and immaterial spaces, between the visible and the invisible. Sound carries dynamism and empowers the cube to guide the conversation. Organized sounds, or music carries in its

essence the elements of time, space, and matter. And most important, it deploys them in a viscous relationship with the listener, "… music reveals the dynamic depth of the space, not at a distance, how vision does, but at the inside of the most intimate proximity, as living depth." [5]

3. Light/Optical System: the possibility of controlling color is an essential characteristic for the multi-sensory composition of the cube, since it comprises one of the primary sensory stimuli human beings have: the distinction of colors. This ability came with evolution, where humans developed a deeper sense of the visual by adding the layer of color.

There is a strong tradition of color and sound association. Even though these are very appealing relationships, they are not totally consistent; thus color vision is not entirely consistent either. It changes and varies through different individuals. A standard human viewer has a trichromatic vision, though a few alterations can occur and alter the perception of color by having partial blindness, color blindness or tetrachromacy (a genetic modification presented only in women). This is why color-to-sound models are subjective and not very consistent.

Even though color and sound correlation models are subjective, they still give us a tool or an extra layer to convey information and materiality. Other than color, visual stimuli can be achieved with light, like in Bryon Gysin's Dream Machines, achieve varying mental states through calibrating particular frequencies of sound and flickering light.

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4. Sensory/Reactive System: the tactile dimension implies proximity; it opens the possibility of physicality and a more direct relation. Touch is an action that takes place in the most personal sphere: touching something always implies being touched in return. It conveys closeness and at the same time vulnerability; it conceives sensuality as well as danger, among other emotions. The cube's Sensory System is reactive to touch at five distinct points. Though it can touch the user with all of its rods, this empowers the cube, being sometimes scary, sometimes intimidating. This is why inviting the user to touch it is also a way of breaking down this notion of control, making the cube also vulnerable to the human body inside. This provides a relationship between action and reaction, it presents a dialogue, and it sets a dance.

It is important to refer to the concept of haptocentrism. This notion comes from Derrida's logocentric action of deconstructing the sense of vision (heliocentric or optocentric) as the primordial human sense and exalting touch as the main sense. The haptocentric paradigm establishes that "touch is the sense par excellence of autoaffection. Wherever there is flesh, Derrida seems to imply, there is auto-affection... Just as in The Voice and the Phenomenon three decades earlier, Derrida had outlined why Husserl's notion of the voice led to auto-affection ("speaking is hearing oneself speak"), in On Touching - Jean-Luc Nancy, carnal auto-affection of touch completes the picture ("touching is touching oneself")." [6]

Following Derrida's ideas, a better relational body is constructed by heightening the sense of touch. This allows us to create tighter relationships since through physical contact, humans can create meaningful embodied affective memories. Human beings are physical three-dimensional bodies that are expressed through the exchange of matter, using material interaction to build immaterial experiences.

Fig 5. *Interior view*, human touching the cube during performance, installation.

3. Relationship

"How could movements of deterritorialization and processes of reterritorialization not be relative, always connected, caught up in one another?" [7]

The concept of Rhizome presented by Deleuze and Guattari sets up the relational aspects of the dance between

the cube and the person inside of it. The cube becomes a symbiotic environment, which gives and receives, that changes, that affects, that is changed and is affected, giving place to a transversal relationship; like a dance, an embodied dialogue. This way of communicating with an architectural space evolves from an exercise of embodied cognition. The environment plays a formative role in the development of cognitive processes of the human inside of it. This person relates to a new type of room, one that is constantly changing, always demanding his attention, telling a story and guiding an interaction.

The interesting thing about a relationship like this one is that it has no beginning or end. It takes place in the middle, on the encounter of the cube and the person. The aesthetic interaction goes from one to the other, feeding the system and transforming both of them (the cube and the individual) as limitless bodies of continuous transference.

Fig 6. *Interior view*, multisensory kinetic environment with human in its inside.

The cube presents a set of territories that can create assemblages, uniting and articulating among them. All the sensory modalities are territories that can be presented and explored. So the performance or the relationship is constructed upon the idea of a constant territorialization and deterritorialization. This is given by the constant variation of situations and state changes, creating a loop of cycles ceding and gaining control. These territories provide the aesthetic material for this experience to be able to construct meaning.

The Cube is a room, a stage, a performer, a dancer, an instrument, and a reactive feeling body all at the same time. It can build a symbiotic relationship of giving and receiving. Essentially initiating a dance that reorganizes our relationship with our environment by allowing an individual to step into the center of the construction and deconstruction of a space that performs itself.

How can an expressive environment like this one effect and change the way we compose music, spaces, and aesthetic experiences? How can the relationship with this room modify the way we interact with and understand the built environment? How much attention do we pay to the bodies we inhabit and other non-human agents around us?

3.1. Choreography

"Choreography is tied to Biology. Choreography gets its start from something about our nature. It is grounded in our biology." [8]

The composition of the sensory choreography will unite three main parts: the human body, the cube, and the proposed sensory stimuli. This creates a relationship between the three of them by combining them on a single unified construct. This composition will combine different sensory stimuli that will transform the cube into a synesthetic synthesizer. Synesthesia has been a vastly studied topic among scientific and aesthetic research. Though, even if similar, the notion of kine-synesthesia has been less explored. As the researcher Francesco Spampinatto [9] establishes, this concept applies to psycho-sensory-motor characteristics of sensory association, in other words, adding embodied motion. It brings the notion of kinetic to the conversation, and also adds the concept of physicality to the original synesthesia model.

The formulation of the sensory choreography implies the composition and disposition of situational elements on time, thus also on space. Time is never an isolated phenomenon, but it is the element that configures the dialog between the content. Time appears at the moment of mediating the dialog of the parts. Time is the element that denotes the different material and affective aspects of the composition. This capacity of time gives it the particularity of providing a dynamic order, re-configuring static and flat elements into a set of physical and three-dimensional elements. This way, time transforms itself into a spatial factor.

"So we can formulate this law: perception is master of space in the exact measure in which action is master of time." [10]

Conclusions

When spaces move, they not only transform what we understand as a building, but they also change our presence in it. Their movement makes us aware of our body's relation to change and time. Interactive or kinetic architectures have the power to mutate our physical and psychological milieu. In addition to this, the polymorphism of the cube is given not only by its flexible fabric walls, but also by sounds, lights, colors, and vibrations. The objective is to achieve an organized whole, where the sum of its parts reveals the expressiveness of a system where no isolated element is predominant and all the parts exist in a fluent dialogue between each other. One way to approach making a composition for the cube is to create a series of situations that guide the user seamlessly through diverse scenarios. This fluent arrangement of sensory elements will construct a sensory mass, an amalgamated atmosphere that envelops the user and transports the human inside to a physical world of sound.

Although the cube has many limitations, it is a great tool for programmable spaces, for diverse perceptual studies and sensory mapping. An important lesson was the relational aspects of the project that opened up a deep study of bodyand-space interaction and the elements that construct emotional relationships via material memory. The outcome allowed this project to present a first prototypical model that proposes architecture as a medium not only for a purpose, but also for an effect. Other very important conclusion from building and experimenting with the cube is to understand that the machine is finite, however the person who interacts with it is not. This project exposes the encounter between an artificial object and an organic creature. This project bridges the interaction between finite and infinite, it frames the setup for a poetic relationship between things and beings.

References

[1] Donna Haraway, A Cyborg Manifesto: Science, Technology, and Social-Feminism in the Late Twentieth Century, in Simians, Cyborgs and Women: The Reinvention of Nature,153.

[2] Vittorio Gallese, Bodily Framing, in Experience, Culture, Cognition, and the Common Sense, edited by Carlonie Jones, David Mather and Rebecca Uchill, 240.

[3] Marvin Minsky, The Society of Mind, 29.

[4] Francesco Spampinato, Les Métamorphoses du son, Matérialité imaginative de l'écoute musicale, 174. Translation by the author.

"Le sens le plus important de notre corp, c'est le toucher... L'ouïe se lie au toucher d'un point de vue phylogénetique (dans les organes de la ligne latérale du poisson, consacrés ä- la fois ä- la réception de stimuli pressifs et d'ultrasons, puis évolués en organes auditifs chez les amphibiens, jusqu'ä- nos oreilles) et d'un point de vue ontogénétique (les vibrations sonores sont saisies par le foetus ä- travers le captage de pressions du liquide amniotique sur l'épiderme; au cours de la phase prénatale on peut parler d'une "oreille globalle", ä- savoir de toute la peau "ä- l'écoute"). Ainsi, se dessine une vision "haptocentrique" de la sensibilité humaine, oü- le contact tactile est la source des associations synesthésiques et des associations affectives de l'homme."

[5] Brandon LaBelle, Background Noise, Perspectives on sound art, Introduction xi.

[6] Emmanuel Alloa, Getting in Touch: Aristotelian Diagnostics, in Carnal Hermeneutics, Perspectives in Continental Philosophy, edited by Richard Kearney and Brian Treanor, 205.

[7] Gilles Deleuze and Felix Guattari, Rhizome, in A Thousand Plateaus, Capitalism and Schizophrenia, 10.

[8] Alva Noë, Strange Tools, Art and Human Nature, 15.

[9] Francesco Spampinato, Les Métamorphoses du son, Matérialité imaginative de l'écoute musicale, 142. Translation by the author.

"Le corps devient lectuer de l'expérience parce que l'écoute s'accompagne d'une micro-reproductionempathique des configurations tensives de la musique, à travers l'adoption de certains patterns de tonus musculaire: une "micro-danse imitative".

[10] Henri Bergson, Matter and Memory, 32.

Bibliography

Bennett, Jane. 2010. Vibrant Matter, A political ecology of things. Durham and London: Duke University Press.

Bergson, Henri, translated by N.M. Paul and W.S. Palmer. 1996. Matter and Memory. 5th ed. New York. Zone Books.

Blesser, Barry, Salter, Linda-Ruth. 2009. Spaces Speak, Are you listening? Experiencing aural architecture. Cambirdge: MIT Press.

Born, Georgina. 2017. Music, Sound and Space, Transformations of Public and Private Experience. Cambridge, UK: Cambridge University Press.

Chouvel, Jean-Marc, Solomos, Makis. 1998. L'espace: Musique/ Philosophie. Paris: L'Harmattan.

Deleuze, Gilles, Guattari, Felix. 2016 (16th edition). A Thousand Plateaus, Capitalism and Schizophrenia. Translation by: Brian Massumi. Minneapolis: University of Minnesota Press.

Feld, Steven. 2015. "Acoustemology". In Keywords in Sound, edited by David Novak & Matt Sakakeeny. Duke University Press. 12-21.

Fox, Michael. 2016. Interactive Architecture, Adaptive World. New York: Princeton Architectural Press.

Haraway, Donna. 1991. "A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century," in Simians, Cyborgs and Women: The Reinvention of Nature. New York: Routledge. 149-181.

Jones, Caroline, Mather, David, Uchill, Rebecca. 2016. Experience, Culture, Cognition, and the Common Sense. Cambridge: MIT Press.

Kearney, Richard, Treanor, Brian. 2015. Carnal Hermeneutics, Perspectives in Continental Philosophy. New York: Fordham University Press.

LaBelle, Brandon. 2013. Background Noise, Perspectives on sound art. New York: Bloomsbury Academic.

Latour, Bruno. 2004. Politics of Nature, How to Bring the Sciences into Democracy. Cambridge, MA and London, England: Harvard University Press.

Latour, Bruno, Yaneva, Albena. 2008. "Give me a Gun and I will Make All Buildings Move : An ANT's View of Architecture." Explorations in Architecture: Teaching, Design, Research. edited by Reto Geiser. Basel: Birkhäuser. 80-89.

Leitner, Bernhard. 1978. Ton : Raum, Sound : Space. New York: New York University Press.

Merleau-Ponty, Maurice. 2012. Phenomenology of Perception. Trans. Donald A. Landes. New York: Routledge.

Minsky, Marvin. 1986. The Society of Mind. New York: Simon and Schuster.

Noë, Alva. 2016. Strange Tools, Art and Human Nature. New York: Hill and Wang.

Pallasmaa, Juhani. 2012. The eyes of the skin, Architecture and the senses. John Willey & Sons Ltd.

Spampinato, Francesco. 2008. Les Métamorphoses du son, Matérialité imaginative de l'écoute musicale. Paris: L'Harmattan.

Tibbits, Skylar. 2016. Self-Assembly Lab: Experiments in programming matter. Routledge.

Torpey, Peter A. 2009. Disembodied Performance: Abstraction of Representation in Live Theater. S.M. Thesis: Massachusetts Institute of Technology, Media Arts and Sciences.

Varela, Francisco, Thompson, Evan, Rosch, Eleanor. 1991. The Embodied Mind: Cognitive Science and Human Experience. Cambridge: MIT Press.

Yaneva, Albena. 2008. "How Buildings 'Surprise': The Renovation of the Alte Aula in Vienna," in Science Studies: An Interdisciplinary Journal of Science and Technology Studies, special issue "Understanding Architecture, Accounting Society".21(1).

Young, La Monte, Zazeela, Marian. 2004. "Dream House". In Selected Writings La Monte Young & Marian Zazeela, edited by M. H. Tencer. Ubuclassics. 10-16.

Some*body* on stage: Reviewing interactive body augmentations in performing arts.

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Abstract

This paper examines how interactive technologies contribute to artistic reflections on human body augmentation. It introduces digital performance, the reference field for this study, and narrows it to interactive practices. It outlines non interactive body augmentations and discusses how the incorporation of real-time interactivity led to the creation of new artistic explorations. It presents interactive on-body projections and human-machine systems as novel art practices that extended the state of art in body augmentation.

Keywords

Digital performance, human-computer interaction, staged interactivity, augmented bodies.

Introduction

Many artists look for new ways to augment and intensify their performances with technological artefacts (Birringer, 2008; Broadhurst & Machon, 2006; Dixon, 2007). Such artefacts contribute to the creation of unparalleled aesthetic and new perceptual experiences (Salter, 2010). In the past decades, we have experienced advances in hardware and software applications (Poole & Le-Phat Ho, 2011) that have an evident influence on performing arts. The popularisation of computer technologies facilitates their integration into traditional performing arts like theatre, dance or performance. Musicians, dancers and choreographers apply digital technology on stage. Furthermore, new art genres such as virtual theatre (Reeve, 2000), augmented dance (Sparacino, 1999) or telematic opera (Deal & Burtner, 2011) appear. Digital performance is a term that includes all these art practices. According to Dixon (Dixon, 2007) digital performance includes "all performance works where computer technologies play a key role rather than a subsidiary one in content, techniques, aesthetics, or delivery forms". Digital performance constitutes a reference field for this study, because (in its wide spectrum of artistic activities) it includes staged performances that involve live human-computer interaction: artistic practices that we analyse and discuss in this work. Current human-computer interfaces based on computer vision, external or wearable sensors allow to sense the properties of the human body and register its actions without any need of manipulating a physical device (like in the case of a mouse or joystick). They use as input data gestures, body proximity and location, eye gaze position and even physiological data like blood pressure or heart beat rate (Jain, Lund, & Wixon, 2011). They are especially suitable for performing arts since they have no arbitrary constraints on performer's actions.

The union of digital performance practices and technology able to mediate real-time interactivity resulted in new insights into already existing artistic explorations. In this work we focus on one particular area that showed new creative possibilities with the incorporation of interactivity on stage – we present practices that explore body augmentation. We define body augmentation as practices that make use of physical and digital resources like costumes, light projections, fabric and metal constructions, robotic extensions, wooden or wire appendages to overcome the limitations of the human body and extend its possibilities. In the following sections we present examples of diverse approaches to body augmentation in both non-interactive and interactive context.

Non Interactive Body Augmentation

First, we present three artists and performers that reflect on body augmentation without usage of any interactive technology. Each of them worked on body extension with particular artistic purposes and technical means, so we have decided to present their works as interesting examples of different approaches to body augmentation in performance.

Loie Fuller

American dancer Loie Fuller is known for innovative experiments with technology with the aim of transforming and enhancing her body (Anderson & Pantouvaki, 2014). In her performances, she works with coloured lamps, reflector technologies and cane-shaped wooden appendages below her ample costumes. She uses them to augment the natural range of movement of her body and so, to add volume, dynamic flexibility and an airy quality to her dance (Veroli, 2009).

By projecting coloured lights onto her spacious dresses, she extends the bodily art form of dance with elements of visual

language like colour and form, introducing threedimensional rotating and morphing screens formed from her loose costume's cloth (Brandstetter, 2015). She uses the combination of light, mechanics, bodily gesture and fabric to transfigure her body into metaphors of animals or flowers (Schiller, 2003). In her body augmentation experiments she converts her costumed body into a rhythmically moving shape of changing forms.

Oskar Schlemmer

Another artist that aims to "enlarge it [the body] beyond its dimensional and temporal limitations" (Gropius, 1961) is German painter, sculptor, designer and choreographer Oskar Schlemmer. In his dance performances, he uses wooden sticks, wire and abstract costumes as technical augmentations of the body to amplify and alter the human form and extend it into space. With this means, he aims to explore the relationship between the organic geometry of the human body and the abstract geometry of the surrounding space (Lahusen, 1986).

He explores the potential of physical transformations inherent in costumes and masks to transform the body and convert dance movements into spatial sculptures (Brandstetter, 2015). In his performance pieces the body becomes a costumed instrument in motion which acquires a nonrealist, abstract and metaphysical dimension (Birringer, 1998). He uses these resources to "free man from his physical bondage and to heighten his freedom of movement beyond his native potential" (Gropius, 1961).

Rebecca Horn

Rebecca Horn's body augmentation practices focus on the renewal of her perceptual possibilities through wearable physical appliances (Wright, 2009). In her performance White Body Fan (Media Art Net, 2018b) she uses winglike fabric and a metal construction that allows her to extend her body capacities and feel the movements of the surrounding air (Art and the Imaginative Promise, 2018). Besides the White Body Fan, she works on body augmentation in the performances Unicorn, Head Extension, Pencil Mask, Cockfeather Mask, Arm extensions, Finger Gloves and Cockatoo Mask, where she explores the perceptual relationship between the body and the mind (Wright, 2009).

Fuller, Schlemmer and Horn make use of body extensions with different artistic goals: to extend body possibilities and movement range and to enhance the performer's perceptions. They achieve their goals through illumination techniques and concrete physical materials. Real-time interactivity enables new different types of body augmentation that we discuss in the following section.

Interactive Body Augmentation

In this section, we discuss two new means of artistic expression that emerged with the incorporation of interactive technologies on stage: interactive on-body projections and interactive human-machine systems. They are examples of how we can augment the body by both invasive (humanmachine systems) and non-invasive (on-body projections) solutions.

Interactive On-Body Projections

Live on-body projections have been on the performance stage since the early experiments of Loie Fuller at the beginning of the twentieth century (Dixon, 2007). Her wide, illuminated dresses become changing dynamic costumes. However, there is no exact coincidence between the projection and the dancer's body or costume. Part of the projection illuminates the performer and the rest, the stage. To synchronise both parts (the body and projection) a system capable of analysing in real-time the position of the performer and generating the corresponding graphics is needed. This becomes possible with the appearance of whole-body tracking techniques based on computer vision, depth sensors or wearable sensors. These technologies enable the usage of interactive costumes perfectly fitting the performer's body. Performers become moving projection surfaces (Beira, Carvalho, & Kox, 2013). Due to the possibility of an instantaneous adaptation of the projection's position and dimensions, live on-body projections leave room for improvisation and the personal voice of the performer (Barnett, 2009). They enhance the expressive potential of the performer whose body becomes extended and reconfigured through digital images (Mocan, 2013). The projections make the performer visually transcend the limitations of his/her physical body, while at the same time the living, breathing body of the performer used as a screen "humanizes the digital image" (Barnett, 2009). This combination transforms the performer into "something other than purely human or purely digital" (Masura, 2007) and is an example of a new powerful tool for artistic expression in the area of body augmentation. Interesting examples of on-body projections are the works of Klaus Obermaier. For example, in his interactive dance performance Apparition (DeLahunta, 2018), he combines frontal on-body projection and almost ten meters wide background projections, leading the aesthetics of the piece towards immersion (Boucher, 2014). His idea of the piece is to reflect about how we interact with digital systems (Mocan, 2013). Obermaier do not just simply project a pre-rendered video onto the body, he creates the projected content in response to the performer's body dynamics. The body features transform the architecture of the realtime generated space projected onto the dancers. The visual effects are rendered more fluidly or rigidly depending on the performer's movement. Obermaier states that in this configuration "the overall interactive system is much more than simply an extension of the performer, but is a potential performing partner" (DeLahunta, 2018). This piece is an outstanding example of on-body projections, where the interactive relationship between the performer and the

projected image merge both parts in a "visually and dramatically coherent whole" (Boucher, 2014).

The human body augmentation techniques that we have presented so far serve to enhance the perceptual and expressive potential of the human body through physical appliances or interactive projections. They are used as an artistic resource to intensify performers' interpretation in dance, performance or theatre pieces. However, body enhancement through technology itself becomes an important field of artistic exploration in digital performance, as it encourages artistic reflections on the nature of the body, robotic body extensions and cyborg bodies.

Interactive Human-Machine Systems

With the appearance of interactive technologies artists starts to experiment with body augmentation using robotic prosthesis and hybrid human-machine systems and presented them on stage (Featherstone & Burrows, 1996). These practices are frequently motivated by the desire to explore the possible fusion of the human body with technology (Parker-Starbuck, 2011) and to reflect on body condition, evolution and adaptation in a technological environment (Kac, 1997). The integration of artificial components or technology and the human body is a complex subject involving the hope of enhancing human abilities, but also has negative connotations, as it displaces the biological, live or real (Masura, 2007). It has been discussed from the philosophical, ethical and artistic points of view by many writers, artists and performers (Cleland, 2010; Giannachi, 2004; Macneill, 2011; Zylinska, 2002). Here we present two human-machine systems that approach body augmentation differently: using the body as a source of input data for robotic extensions and using body as an output device.

Robotic extensions Different artists experiment with the conjunction of the natural and the technological using robotic body extensions (Antúnez Roca, 2018; Bokowiec & Wilson-Bokowiec, 2008; Kac, 2000; Kevin, 2018). As an example of a robotic extension used for artistic purposes we present one of the best-known performance objects of the Cyprian performer Stelarc: The Third Hand (Stelarc, 2018). It is a mechanical human-like hand, controlled by electrical signals from his abdominal and leg muscles. This robotic device is capable of grasping and rotating and has a tactile feedback system intended to provide a rudimentary "sense of touch" (Stelarc, 1991). He developed it to explore the conjunction of technology and media with the body (Stelarc, 2018) and to expand his power and reach (Stelarc, 1991). Stelarc used it in one of his first robotic performances in 1981 at Tamura Gallery in Tokyo where he investigated the possibility of writing "THE THIRD HAND" with his right and artificial hand at the same time (Kac, 1997). This work incites reflection on the human body by focusing on its limitations and then visualising its potential extension through technology. Although Stelarc's performances are frequently viewed as controversial, without doubts they helped open the debate on body limits and our changing nature as humans (Masura, 2007). They are relevant examples of the usage of interactive systems on stage where the human-computer interface is a subject of artistic reflection.

The exploration in the field of human-machine systems takes another interesting track when the human body is used as an output interface.

Body as an output device We use the term body as an output device, to denote practices that use the body as an output interface of an interactive computer-mediated system. In these practices, the performer's body becomes an object of manipulation using, for example, computerinterfaced muscle stimulation systems. The body is presented as an operational structure connected to a computational system and controlled by external factors (Elsenaar & Scha, 2002).

The use of the body as an output device presents an intriguing example of a new configuration of computational systems and the human body, completely opposite to the classical human-computer configuration where the human body is the source of input data and the computer generates digital output as a response. It is a significant new mean of artistic expression grounded in a novel interpretation of human-computer interaction systems. Artistic explorations that use human body as an output device contribute provocative reflections on the manipulation of the human subject (Masura, 2007), on the consequences of reducing the body to a display device and on the relation between the human and the computational system including the Internet (Farnell, 1999).

Stelarc's Ping Body (Media Art Net, 2018a) performance premiered in 1996 in Sydney is an interesting example of this kind of practice. In this piece, a computer program sends messages over the Internet to more than 30 domains around the world and measures the time of response of each domain (Elsenaar & Scha, 2002). The measured delays (from 0 to 2 seconds) are then transformed into electrical discharges between 0–60 volts and applied to the multiple muscle stimulators attached to the performer's naked body (Media Art Net, 2018a). The involuntary gestures caused by the electrical shocks turn the performance into an odd dance choreographed by data streams. This performance presents an interesting inversion of the usual relation between the body and Internet: "instead of collective bodies determining the operation of the Internet, collective Internet activity moves the body" (Masura, 2007). It is also an important example of body augmentation where the body "is no longer the body as a closed unit but a data-body and an every-place body" open to external information and interaction (Masura, 2007).

Conclusions

The term performing arts includes many very diverse practices, but all of them are carried out in front of a live audience and use the performer's body and presence as a medium of artistic expression. How this body can be

augmented to cause new aesthetic experiences and reflections, is a
fascinating question that leads to many diverse artistic explorations.

We presented and analysed both non interactive and interactive examples of body augmentation. In non interactive practices we identified artistic explorations that enhance human body presence, movement range and perception through light projections and physical appliances.

The appearance of interactive technologies related to body sensing and tracking, as well as the possibility of manipulation of digital sound, image and robotic systems, introduce a new type of real-time interactivity into live performances: interactivity between the performer and digital media presented on stage. It enables new approaches to body augmentation: interactive on-body projections and human-machine systems. In interactive on-body projections, videos and graphics projected onto the body surface create a mixture of the virtual and the in-the-flesh performer that visually transcends the limitations of the human body. Finally, human-machine systems augment the capacities of the body and inaugurate reflections on body condition in this new human-machine relationship. Performers are reflecting on the place of the human in this new relation by using the body as both, a source of input data and an output device. It is important to stress that these art practices could not have emerged without humancomputer interfaces that are both: the subject of artistic contemplation and a technological tool used on stage. We hope that this kind of reflections will be constantly contributing to critical judgment of this, still quite incipient human relationship: relationship with computers and information technology.

Acknowledgements

No identifying information allowed.

References

Anderson, A., & Pantouvaki, S. (2014). *Presence and Absence: The Performing Body*. Inter-Disciplinary Press.

Antúnez Roca, M. l. (2018). Afasia. Retrieved from http://marceliantunez.com/work/afasia/

Article: Art and the Imaginative Promise. (2018). Icarus Redeemed: Rebecca Horn. Retrieved January 12, 2018, from http://articlejournal.net/2008/01/03/icarusredeemed-rebecca-horn/

Barnett, A. (2009). The dancing body as a screen: Synchronizing projected motion graphics onto the human form in contemporary dance. *Computers in Entertainment*, *7*(1), 5.

Beira, J., Carvalho, R., & Kox, S. (2013). Mixed reality immersive design: a study in interactive dance. In *Proceedings of the 2013 ACM International Workshop on Immersive Media Experiences* (pp. 45–50).

Birringer, J. H. (1998). *Media & Performance: along the border*. JHU Press.

Birringer, J. H. (2008). *Performance, Technology, & Science*. Paj Publication.

Bokowiec, M., & Wilson-Bokowiec, J. (2008). The Suicided Voice. In *8 th International Conference on New Interfaces for Musical Expression NIME08* (p. 388).

Boucher, M. (2014). Screen Position and Proprioception. *The International Journal of Screendance*, *4*.

Brandstetter, G. (2015). *Poetics of Dance: Body, Image, and Space in the Historical Avant-Gardes*. Oxford University Press, USA.

Broadhurst, S., & Machon, J. (2006). *Performance and technology: practices of virtual embodiment and interactivity*. Palgrave Macmillan.

Cleland, K. (2010). Prosthetic Bodies and Virtual Cyborgs. *Second Nature: International Journal of Creative Media*, *2*(1), 74–101.

Deal, S., & Burtner, M. (2011). Auksalaq, A telematic opera. *International Computer Music Conference Proceedings*, *2011*. Retrieved from http://quod.lib.umich.edu/i/icmc/bbp2372.2011.103/1

DeLahunta, S. (2018). Apparition. Retrieved January 2, 2018, from http://www.exile.at/apparition/background.html

Dixon, S. (2007). *Digital Performance. A History of New Media in Theater, Dance, Performance Art, and Installation*. MIT Press.

Elsenaar, A., & Scha, R. (2002). Electric Body Manipulation as Performance Art: A Historical Perspective. *Leonardo Music Journal*, *12*, 17–28.

Farnell, R. (1999). In Dialogue with Posthuman Bodies: Interview with Stelarc. *Body & Society*, *5*(2–3), 129–147.

Featherstone, M., & Burrows, R. (1996). *Cyberspace/cyberbodies/cyberpunk: Cultures of technological embodiment* (Vol. 43). Sage.

Giannachi, G. (2004). *Virtual Theatres: An Introduction*. Routledge.

Gropius, W. (1961). The Theater of the Bauhaus, trans. *Arthur S. Wensinger, Middletown (Connecticut)*. Wesleyan University Press.

Jain, J., Lund, A., & Wixon, D. (2011). The future of natural user interfaces. In *CHI'11 Extended Abstracts on Human Factors in Computing Systems* (pp. 211–214). Kac, E. (1997). Foundation and Development of Robotic Art. *Art Journal*, *56*(3), 60–67.

Kac, E. (2000). Time capsule. *AI & SOCIETY*, *14*(2), 243–249.

Kevin, W. (2018). Project Cyborg 2.0. Retrieved January 2, 2018, from http://www.kevinwarwick.com/projectcyborg-2-0/

Lahusen, S. (1986). Oskar Schlemmer: mechanical ballets? *Dance Research: The Journal of the Society for Dance Research*, *4*(2), 65–77.

Macneill, P. U. (2011). The arts and medicine: A challenging relationship. *Medical Humanities*, *37*(2), 85–90.
Masura, N. L. (2007). *Digital Theatre: A "live" and Mediated Art Form Expanding Perceptions of Body, Place, and Community*. University of Maryland.
Media Art Net. (2018a). Stelarc: Ping Body. Retrieved January 2, 2018, from http://www.medienkunstnetz.de/works/ping-body/
Media Art Net. (2018b). Rebecca Horn: White Body Fan. Retrieved January 12, 2018, from http://www.medienkunstnetz.de/works/weisserkoerperfaecher/
Mocan, R. (2013). Klaus Obermaier--``My work is not simply visualization. It's a totally different thing!''. *Ekphrasis*, (2), 250–262.
Parker-Starbuck, J. (2011). *Cyborg Theatre: Corporeal/Technological Intersections in Multimedia Performance*. Palgrave Macmillan.
Poole, D., & Le-Phat Ho, S. (2011). *Digital Transitions and the Impact of New Technology On the Arts*.
Reeve, C. (2000). Presence in Virtual Theater. *Presence: Teleoperators and Virtual Environments*, *9*(2), 209– 213. http://doi.org/10.1162/105474600566727
Salter, C. (2010). *Entangled: Technology and the Transformation of Performance*. Cambridge and London:
MIT Press.
Schiller, G. (2003). *The Kinesfield: a study of movementbased interactive and choreographic art*. University of
Plymouth. Retrieved from http://pearl.plymouth.ac.uk/handle/10026.1/2384
Sparacino, F. (1999). Augmented performance in dance and theater. *International Dance ….* Retrieved from http://effetsdepresence.uqam.ca/upload/files/articles/augmented-performance.pdf
Stelarc. (1991). Prosthetics, Robotics and Remote Existence: Postevolutionary Strategies. *Leonardo*, 591–595.
Stelarc. (2018). Third Hand. Retrieved January 2, 2018, from http://stelarc.org/?catID=20265 Veroli, P. (2009). Loie Fuller's Serpentine Dance and Futurism: Electricity, Technological Imagination and the Myth of the Machine. *Avant Garde Critical Studies*, *24*(1), 125–147.
Wright, E. (2009). My Prosthetic and I: Identity Representation in Bodily Extension. *FORUM: University of Edinburgh Postgraduate Journal of Culture & the Arts*, *8*.
Zylinska, J. (2002). *The Cyborg Experiments: The Extensions of the Body in the Media Age*. A&C Black.

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Museum as interface:

the implosion of the white cube and radical museology

Abstract

The transformations that took place in the last century have brought about profound changes to the fields of culture and of public cultural policies. What can be noted, in the specific case of Brazil, is a progressive weakening of the role of the State in espousing cultural democratization, here understood not only as providing access to culture, but also as promoting initiatives that foster cultural diversity. In recent years, a dismantling of the policy area of culture and the arts has been noted, as is generally the case in times of economic crisis, once culture and the arts are generally regarded as having secondary importance vis-à-vis other areas under the domain of the State.

A debate over the role of the institutional context, particularly as regards the public sphere, is followed by the perception of a lack of congruence between institutional practices – which are often directed exclusively at the development of 'spectacular' proposals – and actions that can create dialogue with and lead to effective participation of the public in its diversity.

In this context, the question that is therefore raised is:

-What is the place of art institutions that propose more experimental strategies, different to those produced by institutional spaces driven by the promotion and dissemination of more spectacular proposals?

Keywords

Contemporary art, museum, experimental, interface

1. Decolonization of Museums: Art Collection and Power

This question has been posed by a number of thinkers and theorists for some time now. It is not by chance that in *On the Museum's Ruins*, American critic and art historian Douglas Crimp heralds the death of the art institution, and in particular of museums.

In dialogue with Hans Belting and Artur Danto, Crimp calls the modernist version of the museum into question, or, more precisely, the version of the museum that operates according to a museological belief that the representation of art is a homogenous and purportedly universal system, and that has therefore constructed a history of art in resonance with its 'ideal' classification.

On the one hand, this supposed universality has allegedly been debunked, be it due to the existence of cultures that are far from identifying themselves with the Euro-Western model, or due to the fact that the traditional model of narrating history according to particular styles and characteristics, all of which linearly converge into a point in time, was no longer capable of addressing the plurality of modes of artistic production that emerged in the field of art after modernism.

It is not by chance that a surge in discussions has been observed – both within the domain of art history's narrative and in actions related to the sphere of museums – promoting a process of 'decolonization' of museums and the need to liberate our collections from an imperial and hegemonic Euro-Western perspective. Javier Rezzano, coordinator of Uruguay's National System of Museums, defines the term decolonization in its widest sense. To him, to 'decolonize' the museum necessarily means making it more inclusive and bringing it closer to the community that he worked for.

To declare the death of the museum has since become a tradition that has been maintained over the course of more than a century; we need only to recall the Futurists' critique of the obsolete role of the museum. Curiously enough, though, our very century that has likewise continuously proclaimed its death has also been one that has seen an unprecedented and dramatic expansion. Only in São Paulo, we can cite the city's Football Museum, opened in 2008, and the Museum of Sexual Diversity, inaugurated in 2012.

In any case, the point at issue here is not the increase in the number of museums, but relates instead to their fundamental role – despite its purported death sentences – in the art circuit, with regard to circulation, promotion and dissemination of that which we understand as a work of art.

2. White Cube and Museum-Temple

It is interesting to direct our attention to the role of the museum based on the image of a closed space that

is architecturally "neutral", as contained in the term "White Cube".

In his essay "Inside the White Cube", originally published as a series of three articles in Artforum magazine in 1976, artist Brian O' Doherty provides a critique of the modernist aesthetic of the exhibition space, as instituted by the Museum of Modern Art (MoMA) in New York in the first half of the 20th century.

O'Doherty describes the modernist gallery space as "constructed along laws as rigorous as those for building a medieval church." As he defines, the key principle behind this gallery model is that "the outside world must not come in, so windows are usually sealed off. Walls are painted white. The ceiling becomes the source of light."

Introspective and self-referential, the white cube is a "museum-temple", a sacralised environment, aseptic and timeless, distant from the reality of the world.

3. From Museum-Temple to Museum-Spectacle

As privileged grounds for the exhibition of cultural referents, museums have based their existence and their activities on the aura of historical and cultural authenticity of objects that were collected and exhibited over the course of many centuries.

Criteria such as originality, language specificity, universal historical narrative and consecrated exhibition spaces were used to hinge the construction of narratives upon the cultural authority of the museums of modernity.

The impact of new and sophisticated means of communication and the advent of digital culture as a phenomenon of globalization brought about profound changes to the sphere of culture, and consequently to the realm of museums.

The more pessimistic analysis of this new moment defend the idea that the globalization process simultaneously began to drive culture further away from pre-established spatial constraints in radical ways, while also promoting a process of cultural homogenization.

This, in turn, would entail that economic globalization has become inextricably linked to cultural globalization, within a framework in which culture transforms itself into a commodity that is produced and consumed in a global scale. And hence, this led to a process of displacement from the "museum-temple" To the "museum-spectacle".

In an interview to the newspaper *Folha de S. Paulo* granted in the 1990s, American postmodern critic Fredric Jameson diagnostically points out that the field of culture forms one of the main cornerstones of what he terms "late capitalism".

As he says in the interview, "an overwhelming 'dedifferentiation' occurred, wherein the traditional boundaries between economic production the cultural life of people began to be effaced. Culture is (now) business, and cultural products are created for the market (…) mass culture is no longer a set of radio comedies, Hollywood musicals and romantic comedies. It involves a much more sophisticated production, made by talented people (…) following the logic of 'reification', whose final goal is to transform objects of all types into commodities. It does not matter whether these objects are movies stars, feelings or a political experience."

The 'dedifferentiation' to which Jameson refers is not limited to the disappearance of old boundaries between infrastructure and superstructure, but also hauled into the realm of mass consumerism a group of manifestations that until this point had been tagged as elitist – for example, art exhibitions – but which now project themselves in the mediatized programmes as mega-events. They occupy museums, cultural centres and outdoor spaces, attract sponsorships and public and private funding that benefit from tax incentive laws. Itinerant exhibitions by Monet, Rodin, Cézanne and Picasso provides the lure for major business investments that begin at box offices and unfold into the sale of catalogues, reproduction of paintings, films, posters, calendars, t-shirts and other souvenirs.

Many of these institutions tend to resort to a spectacular dynamics in which the number of visitors is one of the key indicators of the event's success – or lack of it.

On the other hand, in some of the more recent shows it is possible to observe a completely different behaviour from the public towards the exhibition and the actual exhibition space. Many people stand in front of the artwork displayed as mobile phone or tablet cameras record their presence in the exhibition; a presence that will later be thrown into the spotlight by way of subsequent sharing of the recorded images on social media, imploding and dispelling the notion of the modernist white cube.

4. Experimental Museums and Radical Museology

Yet it would be an error to believe that this is the only possible model for contemporaneity, especially because the very idea of contemporaneity points towards a non-homogenous panorama. Rather, it signals to a heterogeneous, hybrid perspective, with the aim of encompassing the variegated configurations and formats of present-day museums.

Far from depleting the topic, I would like to refer to the essay titled *Radical Museology, Or, What's Contemporary in Museums of Contemporary Art,* by the English art historian and critic Claire Bishop. In this essay Bishop departs from a critique of a text by Rosalind Krauss "The Cultural Logic of the Late-Capitalist Museum", wherein the American critic, in dialogue with Fredric Jameson's *Postmodernism, or, The Cultural Logic of Late Capitalism*, posits the view that contemporary museums are the expression of a consumerist logic enacted in the domain of art and culture of present times.

In a first instance Claire Bishop acknowledges the inherent difficulty in determining what is contemporary, and the impossibility of consistently making sense of the uses of this notion within a universal or global perspective, not only in light of local conditions and particularities but also of the different museum typologies of our times.

Bishop calls the changing experiences of museums that at present can be regarded as contemporary, and which somehow managed to disentangle themselves from the museum-spectacle model "radical museology". In other words, they represent an alternative to situate the museum institution in the 21st century.

5. Paço das Artes: Livro/Acervo, MaPA and Ex-Paço

Some of the strategies pursued by the Paço das Artes include questioning traditional museum standards and practices, creating more experimental curatorial *dispositifs* and enhancing access to the collection, creating more active and experimental strategies for opening new channels of dialogue and engagement with the public.

Founded in the 1970s, the Paço das Artes, an art institution run by São Paulo State Secretariat for Culture, has over the years been creating a space that centres on experimental art, namely on that produced by younger artists, and the wide diversity of languages being explored.

Seeing the Paço das Artes is not a "museum" in the strict sense of the word, and for this reason, does not have an art collection, precisely in light of its work related to the promotion and dissemination of an entire range of a young Brazilian contemporary art production, the fundamental axis of its 'collection' consists of the endeavor of recording and archiving.

It could be said that the actions performed by the Paço das Artes constitute a sort of Imaginary Museum, as described by André Malraux: the 'collection' of the Paço das Artes takes shape through the engagement of artists, curators, art critics and educators, as well as through the activities proposed and the participation of the public.

It is within the perspective of promoting a debate over the institutional 'collection' of the Paço das Artes, which is not a museum in the strictest sense but is nevertheless set up within the museology division of the São Paulo State Secretariat for Culture, and problematizing its status, and also with the aim of giving voice to other narratives, namely ones that unfold from the young Brazilian contemporary art production that has yet to gain representativeness within the main art circuits, that I conceived a curatorial series centred on Paço das Artes' archive and collection, with exhibitions aimed at giving visibility and creating a space for reflection about the issue.

Livro/Acervo [Book/Collection

Livro/Acervo [Book/Collection] project used the archival material of the Paço das Artes (images, information, catalogue, documents) to propose an itinerant and portable exhibition inside a file box. *Livro/Acervo* was conceived by Daniela Bousso and myself in 2010 to mark the celebration of the 40th anniversary of the Paço das Artes. The initial idea of the project was to develop an extensive curatorial project that rekindled the memory of the Paço das Artes, but also gave the public access to a curatorial endeavor that extended beyond the traditional exhibition space.

It was from this perspective that the idea was born to develop not only a curatorship in the space of the book – as a kind of portable and circulating curatorship – but also to develop a curatorship from the institution's "archive" and "collection" based on one of the most important of all Paço das Artes' projects: the *Temporada de Projetos* [Projects Season].

Livro/Acervo was composed of three main parts[1]. In the first one, 30 artists who participated in the *Temporada de Projetos* were invited to develop a new piece of work on paper – such as the flip book *Naufrágio* [*Shipwreck*], developed by the artist Laura Belém. These works were printed as copies for distribution and bound together in sets with the other items that composed the project. The second part of the project, titled *Enciclopédia* [Encyclopedia], was included in the same booklet as the artists' workbooks, and contained information about each of the artists, curators and members of the jury that

[1] Based on the initial idea for the project, we invited artists Artur Lescher and Lenora de Barros to assist in the conception development of *Livro/Acervo*'s first curatorial proposal.

participated in the *Temporada de Projetos* since its first edition in 1997. The third part of the project was a sound work with a running time of up to one minute, developed by the artists and curators who participated in the *Temporada de Projetos* and incorporated to the volume in the form of CD-ROM. It should be noted that the project (consisting of these three parts) took the form of a box/file, alluding precisely to the idea that this *dispositif* contains an important part of the history of the Paço das Artes and of a portion of Brazilian art produced by newer, often younger names, frequently absent from the official and hegemonic narratives of Brazilian art history.

MaPA

Giving continuity to the *Livro/Acervo* project, in November 2014 we launched an online platform for contemporary art called *MaPA: Memória Paço das Artes* [MaPA: Paço das Artes Memory], which brings together all artists, art critics, curators and jury members that participated in or collaborated with the *Temporada de Projetos* since its inception in 1996.

The platform comprises a database containing over 870 images of works that have been exhibited at the *Temporada de Projetos*, as well as roughly 270 critical texts and video-interviews, all of which were especially created for this project since 2014. Encompassing more than 240 artists, 14 curatorial projects, 70 art critics and 43 jury members, the platform was built as a relational apparatus and as a work-in-progress, providing researchers with the opportunity of accessing information developed from or pertaining to the existing relations arising from the *Temporada de Projetos*.

Once on MaPA's homepage, the user is presented to a series of names of all those involved in the *Temporada*. When clicking any one of the hyperlinked names, MaPA highlights in bold font the other names involved in that particular edition of the *Temporada*. This way, a research path opens up, acting as a relational *dispositif* that enables the user to get to know each artist's trajectory, along with information on and comments made by the critic or jury member who evaluated and/or selected him or her. The emphasis ascribed to these 'relational' histories conveys the idea of dialogue implicit in the *Temporada de Projetos* itself, once it acts as a 'revealer' of talent within the artistic scene. For this reason, the organization of the information and the creation of a reference system embedded in the platform are linked directly to the names of the artists, curators and critics, prominently featuring the individual trajectories and creative development of all those involved in contemporary art production and its system.

MaPA can be regarded not only as an apparatus that rekindles part of Paço das Artes' trajectory and of its 'collection', but also functions a research *dispositif* for all those interested in the paths being pursued and explored by young Brazilian contemporary artists.

Finally, but no less importantly, MaPA is a triggering vehicle for the construction of other narratives of Brazilian art history, and particularly of narratives related to a younger generation of Brazilian artists, which often find no space within or are simply neglected by the 'official' discourses of the history of art.

Ex-PAÇO

As a final project in this trilogy, I would like to call attention to the work-in-process Ex-PAÇO conceived and idealized by Sérgio Nesteriuk and myself as a result of the loss of Paço das Artes' main building, previously located in the University of São Paulo campus.

Ex-PAÇO is a three-dimensional virtual replica of the Paço das Artes[2], with inlets and outlets (local and online) for computers, mobile phones, cardboards and virtual reality goggles. Three-dimensionally modelled based on the last building to house the Paço das Artes, Ex-PAÇO is not only a 'memorial' space, and therefore an endeavour to recapture the institution's old space/building through virtual reality, thus a political space, a space of resistance, so to speak, but an online museum conceived to 'house' different curatorial proposals and contemporary art manifestations.

This new navigable space, suggestively allocated in 'outer space', is the starting point for formulating new curatorial and exhibition-oriented dynamics, potentialized by the latest technologies. However, this does not imply simply exhibiting digital art in a museum or on a website; rather, it refers to the actual exhibition space that becomes digital space, therefore virtual. And this, in turn, opens up myriad new creative possibilities within the exhibition field.

If in *Livro/Acervo* and on the online platform *MaPA* the focus of attention lay in the strategies for access to the 'collection' of the Paço das Artes and all related information, with the ultimate aim of contributing to the construction of a narrative of a younger generation making Brazilian contemporary art, in the Ex-PAÇO project currently being developed the objective is not only to create an online museum, that is, a museum without walls for the development of online curatorial projects, but above

[2] At the end of 2015, Paco das Artes had to vacate the building it had occupied since the 1990s, located in the University of São Paulo campus. Created in the 1970s, Paço das Artes was never housed in a permanent location. At present, the institution functions and operates in a temporary location, where the Museum of Image and Sound (MIS) is situated.

all to shed led on the importance of the Paço das Artes as a space for artistic creation and experimentation.

In this sense it can be seen not only as a mobile space, but also as a virtual space that is both political and critical towards the factors implicated in the loss of the building that housed the Paço das Artes, all of which are reverberations of deeper, underlying present-day issues.

Conclusion

It is in this sense that we understand this museum, which I refer to here as museum-interface, a museum that implodes the concept of white cube" and presents museum/museological and curatorial strategies which somehow project other voices that are not present in traditional spaces – or in those hinged upon a spectacle-oriented culture.

The concept of interface arises from the need to reconceive the museum neither as a temple, nor as a place for entertainment or for the workings of the cultural industry, but as a space that becomes a social interface, fostering a dialogue with its public that is more experimental and closer to everyday social existence.

References

Arantes, Priscila. *Arte @ Mídia: perspectivas da estética digital*. São Paulo: FAPESP/Editora Senac, 2005.

----------.*Re/Escrituras da Arte Contemporânea: história, arquivo e mídia*. Porto Alegre: Ed.Sulinas, 2014.

Bishop, Claire.*Radical Museology*.London, Koenig Books, 2013.

Crimp, Douglas. *Sobre as ruínas do museu*. São Paulo: Martins Fontes, 2005.Freire, C. *Poéticas do Processo: arte conceitual no museu*. São Paulo: Ed. Iluminuras, 1999.

O' DOHERTY, B. NO interior do cubo branco: a ideologia do espaço da arte.São Paulo, Martins Fontes, 2002.

JAMESON, Fredric. "Falso Movimento"; entrevista a Marcelo Rezende, Folha de S.Paulo, 19 de setembro de 1995.

Collaborative Artistic Practices within Indigenous Communities

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Abstract

This article addresses community collaborative artistic practices in general, and, specifically, it reviews two projects within indigenous communities in Brazil and Mexico: "Affective DNA: *kamê* and *kanhru*", a collaborative project developed with the Kaingang indigenous culture of southern Brazil; and "*La lengua del diablo*" (The Devil's Language/Tongue), an audio project aimed at the devalued Nahuatl language of the Cuauhtotoatla community in Mexico. In these projects, theory and practice intertwine to delineate discourses concerning these experiences which constitute collaborative artistic practices of aboriginal peoples, and involve political and cultural issues activated by contemporary artistic and technological processes.

Keywords

Art, Collaboration, Indigenous Communities, Kaingang, Cuauhtotoatla.

Introduction

Artistic practices directed at specific sites and its demands are experiencing a period of great involvement and participation, of ubiquitousness and visibility. There is now a great openness in the artistic productions established between artists and communities. Modes of human interaction often become the main focus of these projects which at different levels entertain direct links with social, cultural and political issues.

According to Bishop (2006), the expanded domain of these "relational" practices is now known by many names such as socially engaged art, community-based art, experimental communities, dialogic art, littoral art, participatory, interventionist, collaborative, research-based or collaborative art. Still, these terms are derived from the elaboration of "relational aesthetics" proposed by Nicolas Bourriaud (2009). In this article, we are interested in thinking about these relational practices as collaborative art, since the term collaboration, as used in the artistic sphere, derives from the semantic meaning of the term "co-labor", that is, to work together in terms of co-production (Kester, 2011, p. 112).

Collective and collaborative artistic practices emerge as part of the 60's and 70's art scene together with the actions of situationist, activist and feminist groups. However, it is during the 80's and 90's that a generation of emerging collectives in the arts intensify issues of collective authorship, collaborative agency and multiple interlocutors arising from shared, rather than singularised, expression given that the main focus of these artists's work was linked to the use of public spaces to site artistic gestures of a political nature (Kester, 2011, p. 114). Thus, this allowed an important bridging of the traditions of conceptual art, public art and activism. Bishop (2012), in turn, maintains that artists of the 1990s willingly tied their work to social and political issues—dovetailing art to a social conscience—even if their productions varied greatly in purpose and proposals. There was a widespread contemporary stance which saw in the creativity of collective action and in shared ideas a form of appropriation of power by artists as social empowerment (Bishop, 2012).

The collaborative artistic practices of the last three decades reveal a set of common specificities, such as: effective exchanges with the community and/or specific groups, engagement with local social issues, intertwining with other areas of knowledge, and collective authorship. And importantly, in addition to being social processual propositions detached from a resultant aesthetic object, the relational interactive exchange becomes the creative praxis itself (Kester, 2006). Over time, more and more methodologies have gained legitimacy which enable artists to work together in a variety of collaborative modalities and artistic projects—such as video collectives, maker labs, workshops, public meetings, group performance protests, etc—which a generation ago would have been offhandedly dismissed as community art (Kester, 2011, p. 9).

Within this creative collaborative dynamic, Kester (2005, 2004) emphasises the essential necessity of dialogue to the extent of elaborating a dialogic aesthetic inspired by Russian literary theorist Mikhail Bakhtin who argued that the work of art can be viewed as a kind of conversation. The dialog as dialectic exchange between the participants of a collaborative artistic project becomes the key element in the outlay of a levelling practice between artists and community. The essential quality of this dialogic is an horizontal equalising of the voices of all the members thus enabling a non-hierarchical attunement towards a more effective collaboration (Kester, 2011).

In observing collaborative community propositions in the arts, we realise that it is not an individual artist working

alone who enters an already substantiated community, intending to define and rescue identities/memories/unity of a certain community. Instead, collaborative proposals develop methodologies in which artists simultaneously constitute themselves and constitute their role in the collective in which they are agent. These methodologies bear within themselves a reciprocal process between the individual (artist) and the community (society), which manifests itself through the sharing of knowledge, desires, habits, looks, gestures, experiences that traverse the body and become its flesh, an aggregation with the collective, a collective agency activated and mapped. We speak not of hierarchy, segregation and exclusion, but of empowerment for the respect of difference and for the power of the collective (Oliveira, 2017).

As such, we look to review two collaborative projects with indigenous communities in Brazil and Mexico: the collaborative project "Affective DNA: *kamê* and *kanhru*", a collaborative project developed with the Kaingang indigenous culture of southern Brazil; and "*La lengua del diablo*" (The Devil's Language), an audio project aimed at the devalued Nahuatl language of the Cuauhtotoatla community in Mexico. In these projects, theory and practice intertwine to delineate discourses concerning these experiences which constitute collaborative artistic practices of aboriginal peoples, and involve political and cultural issues activated by contemporary artistic and technological processes.

La lengua del diablo (The Devil's Language)

This proposition revolves around certain reflections and conclusions based on the development of the sound project called *La lengua del diablo*, as a possibility of experiences of artistic practices and (re)generation of community. This proposal sought to address, using the metaphor of the "devil" within, the loss and devaluation of the Nahuatl language in the northern part of the community of Cuauhtotoatla (specifically in the Nahua neighborhoods of San Isidro Buen Suceso and San Nicolás), in the state of Tlaxcala, east of Mexico City and north of Puebla (Figure 1).

Nahuatl was the language of the Aztecs and their predecessors, the Toltecs, and is one of the first literary traditions in ancient America. It provided the rich cultural backbone to the Mexicas peoples of mesoamerica for oral and written expression through its sophisticated ideographic, glyph writing system which included included some syllabic phonetic glyphs. This language was not only used for the creation of literary texts in prose and poetry but also served for religious ceremonies, political and administrative missives, speeches and for the transmission of popular culture in everyday life (Leander, 2005).

Thus, a cosmic vision of the Nahuas is interpreted through Tlacatecolotl, a deity associated with the notions of Good and Evil and integrates these tensional attributes within ambivalent rites with religious overtones characteristic of the pre-hispanic observances (Baez-Jorge and Gomez-Martinez, 1998). Here, "evil" serves as a threshold concept to question the vitality of the language in this location, to determine if in fact there is a certain negative perception of the Nahuatl in regards to its gradual loss.

Figure 1. *La lengua del diablo,* Community of Cuauhtotoatla, 2018.

La lengua del diablo came to be in 2017 as a result of various audio recordings of interviews and conversations conducted with residents of those neighbourhoods, recordings the outdoors environment as well of space and everyday life. The audio pieces obtained were reproduced through, in the case of San Isidro, the community system of mobile megaphones in which they "dedicate" a variety of announcements and events; while in San Nicolás various the sound pieces were broadcast from fixed points also, using megaphones. The sound activations produced a rupture of the rhythms and daily spatial practices of the community. The project which unfolded over a year, allowed participants to gauge the state of the language by identifying its acceptance and assessing its reception within the general population as well as the identification of active (or potential) agents interested in doing a little more about the recovery of Nahuatl culture and language.

And here identification is not used as a "pointing out" or "indication" but in the sense of affirming members of the community who identify with and wish to participate and share in the initiatives of the project. But "identifying with" was not sought in using the language as identity but in serving as the affordance around which community happens and integrates the work of artists, participants and community.

Thus, this is an initiative of reappropriation of public space by way of audio interventions by the sonic overwhelming and expulsion of the official linguistic spatial occupation of a colonial past. By "drowning out" the ubiquitousness of the official language of domination, *La lengua del diablo* immerses the population in the experience

of an alternative linguistic environment, of producing a new commons, for coexistence using a different means of creating extension: it offers a palpable aesthetic continuity to the virtual and physical space defined by the social and socialising nature of language and its sonic manifestations. By sonically imprinting the Nahuatl language on the community with its own endangered oral traditions and homespun texts, the virtual of a Nahua past actualises the possibility of a future based on the linguistic past for the indigenous population as a people to come.

Affective DNA: *kamê* and *kanhru*

The collaborative artistic project *Affective DNA:* kamê *and* kanhru is a proposition by Brazilian artist Kalinka Mallmann and *Kaingang* history student Joceli Sales linked to Labinter interdisciplinary collaborative art research projects and the Graduate Program in Visual Arts, at the Federal University of Santa Maria in Brazil. This practice is based on actions that encourage active non-forgetting of the specific modes of social organization of the Kaingang indigenous culture, activated by inventive and creative practices with children art and technology.

Presently, there are Kaingang people in the Brazilian states of Rio Grande do Sul, Santa Catarina, Paraná and south of São Paulo. It is estimated that a total population of approximately 34,000 Kaingang are spread throughout various communities or Indigenous Territories (www.portalKaingang.org). The project *Affective DNA: Kamê and Kanhru* was conceived collectively through encounters and meetings between Mallman, Sales and the Kaingang community of Terra do Guarita, located in the northwest part of the state of Rio Grande do Sul, Brazil, the third largest Kaingang community with a population of 5,300 inhabitants.

Specifically, the *Affective DNA:* kamê *and* kanhru project looks to create a collaborative community project within the the Kaingang Indigenous Territory at Terra do Guarita that would develop some actions with the children of the community in order to foment, inspire, and solidify a greater appreciation of *kamê* and *kanhru* values within the community and perpetuate the culture. *Affective DNA: kamê and kanhru* was the name suggested for the project because the marks originate from cosmological and not biological kinship and encompassed the existence of a broad spectrum of connectivity among individuals within an inclusive system of transmission, of information, of collaboration. The project seeks to bring together 'genetic' material from multiple sources in order to create innovative sequences that would otherwise not exist. This concept also resonates with the purpose of the project: to jointly create a connected and collaborative cartography of relationships, exchanges and affects within the community.

The specific actions that were decided collectively in community meetings was to first dialog with the children as to what *kamê* and *kanhru* meant for them in the community. The children then made drawings on digital tablets around this theme and were taught how to use the tablets to take photographs and videos in order to document daily life in the community and tie them to geotags. By means of these geotags, users will then be able to access the audio-visual material produced by the children of the community and others. This material will then be integrated as a cartography on an online interactive platform which can be accessed by members of the community to identify *kamê* and *kanhru* families by using *kamê* and *kanhru* symbology. These actions would incorporate the participation of the children, the parents, the elderly of the community in order to produce a sense of what it means to be *kamê* or *kanhru* within the Kaingang indigenous community.

It was in the initial meetings, that the community was able to determine the overriding theme of the project as the use of the *Kamê* and *Kanhru* markings (*Rá*) which represent the duality of Kaingang society. According to Jacodsen (2013), the dualism refers to a dual perception of the universe which reflects the presence and influence of the Sun and the Moon: the Sun principle is *Kamê*, whereas the Moon principle is *Kanhru. Kamê* expresses the symbolism of the Moon—cold colours and an open geometry; *Kanhru* expresses that of the Sun—warm colours, and a closed geometry. These cosmic principles are also reflected in their leadership system in terms of a social whole composed of two halves, of "opposites and complementaries". Thus, the Kaingang are differentiated between theseves by the *Kamê* and *Kanhru* markings, which are portrayed principally on body paintings used in ceremonies, rituals, festivals, and especially in handicrafts (Jacodsen, 2013). Two parallel lines define the *Kamês*, and a filled circle defines the *Kanhrus*. These distinguishing marks are featured not only in body painting, but are also expressed through the geometry of handicrafts, and in their colours, among other applications.

In terms of kinship, marriage codes also subscribe to this understanding of the cosmos. For the Kaingang, these marks are relevant in order to understand the cultural, social and cosmological conception of the Kaingang people and how they relate to the world. When marriage is performed according to this conception, *Kamé* types should marry only *Kanhru* types and vice versa, and the children will receive only the paternal mark (Jacodsen, 2013); those with the same markings are brothers, and those with different markings are in-laws. The adoption of names and surnames was forced upon them in order to acquire official documentation or to register property, since notaries did not accept Kaingang—many saw this as abject colonisation and subjection and as destruction of their heritage, history and kinship lineages. The population of the Guarita Indigenous Territory has long suffered the process of white man's colonisation, and the practice of *kamê* and *kanhru* markings ended up being almost extinguished by the use of names and surnames imposed by the institutions of the white man. The empowerment implied by the use of the

renewed use of the markings in the Kaingang community is enormous as this becomes a recognition of a Kaingang past and an affirmation of their history as the basis for social organisation. In addition, the practice has bolstered a sense of identity and belonging, as well as perduration amidst the pressure to assimilate into mainstream Brazilian culture. The Guarita Territory is surrounded by urban development, so direct contact with these urban environments has been changing the cultural customs and traditions of the Kaingáng communities who are struggling to maintain "their way of life" in spite of this constantly increasing external pressure (Sales, 2017).

To widen interest in the project and to raise awareness for the work being carried out, several other initiatives were realised. In November 2016, an animation/installation was presented at the exhibition "Art, Topology, Technology—LabInter 2016", at the Carriconde Gallery in UFSM, Brazil. The public exhibit showed a conceptual record of the project itself, which unfolded into other distinct artistic proposals, most markedly through social media.

Figure 2. *Affective DNA: eu sou kamê e eu sou kanhru,* Facebook page, 2017.

One of the actions of the project was to use social media such as Facebook and Twibbon to discuss identity issues within the Kaingang culture and to allow other communities besides the local site of the project to participate in the conversation via online networks with the purpose of cultural activation through art and technology.

The *Affective DNA: kamê and kanhru* Facebook page worked well as a common platform for meeting and communication between individuals belonging to different Kaingang communities. Facebook's online telematic dialogues provided an instant sense of collective belonging. Besides being a form of appropriation of the technology coming from the culture of the white man, the social media gave a collective voice to the communities and enhanced recognition for the indigenous culture. Two graphic templates were created on the Twibbon platform that characterised profile picture of each user as Kaingang *kaméangs* or as Kaingang *kanhrus*: cool colors, open geometry and parallel markings and the title "I am kamê"; warm colors, closed geometry and circular markings and the title "I am kanhru".

As the comments in the Facebook postings were written in Kaingang, something subjective and potent emerged: an aura of belonging and of resistance—belonging emerged with the exhibition of pride in their markings, and resistance from being able to foster a dialog around native and local Kaingang issues in the midst of the ephemeral globalized network.

Figure 3. *Affective DNA: kamê and kanhru,* collaborative cartography, 2018.

In July 2017, we began the process of developing a collaborative mapping in the community of Terra do Guarita by the Kaingang children of the village. This marks the final phase of the project through the production of a collaborative cartography and transferring it to an online map linked to the community school's website. This action is developed with the children as an expanded reality which incorporates simultaneous temporalities and spacialities

within the community by populating it with interviews of relatives, photographs, videos, and oral histories as digital narratives adapted to this map. Following the suggestions of Grant Kester (2011), the actual carrying out of the project with the Kaingang in the indigenous territory becomes a performative artistic gesture where meetings, audiovisual workshop creation, participating in community events, conversation with the members of the community, etc become important means of creative facilitation within collaborative art projects in communities.

Final Considerations

These two projects seek to engage with indigenous communities in order to shelter and preserve their cultural values. *La lengua del diablo* joins the rise of world-wide, language safeguarding initiatives that are now experiencing a resurgence as part of an awakening to the need of preserving and revitalising endangered languages of indigenous peoples (Leander, 2005). This independent project offers guidelines to bring closer the production, artistic practices and the community of the northern zone of Cuauhtotoatla around the Nahuatl language; and the various manifestations and the respective world configured from that language.

In all the actions of the *Affective DNA: kamê and kanhru* project, the focus is on the shared doing and not on the individual propositions of an artist. The propositions originate from a collaborative conception, to the extent that the actions are planned between the artist and the Kaigang history student Joceli Sales, who also assumed the role of representative of the Kaingang community and liaison duties. At each step, there is a greater involvement by individuals who wish to collaborate and participate to produce a certain autonomy to the project as a whole. Because the teachers of the local school were also involved in the project, they incorporated some of the project's practices into the curriculum.

Emerging technologies can now be said to expand collaborative processes and, in this sense, Ana Mélia Bulhões adds that "with the advancement of technological society and communicational possibilities comes the prospect of creating new collaborative actions" (Bulhões, 2011, p. 140). And in the midst of this heightening of collaborative possibility, the artist stands beyond "traditional positions" to simultaneously assume "a lateral position in the mediation process" (Cirillo, Kinceler, Oliveira, 2015, p. 7).

In conclusion, the *Affective DNA: kamê and kanhru* project reveals itself as fomenting indigenous subjectivity. By enabling indigenous people to be the narrators of their own history and activating their own potentials and safeguarding their subjectivity in the midst of today's globalisation processes, such as online networks and social media. In this sense, the artist-researcher becomes a facilitator in this collaborative process. Understanding the project as a collaborative and affective system that transcends the limitations of traditional art practices, art and technology can come to potentialise human relations.

References

Baez-Jorge, F.; Gomez-Martinez, A. (1998). *Tlacatecolotl y el Diablo. (La cosmovisión de los nahuas de Chicontepec)*. Veracruz: Antropologia.

Bishop, C. (2012). *Artificial Hells: Participatory Art and the Politics of Spectatorship*. London: Verso Books.

Bishop, C. (2006, February). The Social Turn: Collaboration and Its Discontents. *Artforum*, 45(2), 178-183

Bourriaud, N. (2009). *Estética Relacional*. São Paulo: Martins Fontes.

Bulhões, M. A. (2011). *Web Arte e Poéticas do Território*. Porto Alegre: Zouk.

Cirillo, J.; Kinceller, J. L.; Oliveira, L. S. de. (2015). *Outro Ponto de Vista: práticas colaborativas na arte contemporânea*. Vitória, Brazil: PROEX-UFES/UFF.

Jacodsen, J. D.; Jagso I. (2013). A importância do grafismo para a preservação e valorização da cultura Kaingang. Kaingang, S. F. (Ed.), *Eg Rá: Nossas Marcas*. São Paulo: DM projetos especiais. p. 13-44.

Kester, G. H. (2011). *The One and the Many: Contemporary Collaborative Art in a Global Context*. Durham, NH: Duke University Press.

Kester, G. H. (2006). Collaboration, Art and Subcultures. *Caderno Videobrasil 02 Collaboration, art, and subcultures*. São Paulo: Edições Sesc-SP e Associação Cultural Videobrasil. Retrieved from: http://site.videobrasil.org.br/publicacoes/caderno/02

Kester, G. H. (2005). Conversation Pieces: The Role of Dialogue in Socially-Engaged Art. In Zoya Kucor and Simon Leung (Eds.), *Theory in Contemporary Art Since 1985*. London: Blackwell.

Leander, B. (2005). Oral and written Nahuatl: Literature from ancient and modern Mexico. *Oralidad Para el Rescate de la Tradición Oral de America Latina y el Caribe.* La Habana: UNESCO. Anuario 14, 8-12.

Oliveira, A. M. (2017). Arte E Comunidade: Práticas De Colaboração Implicadas no Comum. *PÓS: Revista do Programa de Pós-graduação em Artes da EBA/UFMG*. v.7, n.14, 42-60.

Paim, C. (2012). *Táticas de Artistas na América Latina: Coletivos, iniciativas coletivas e espaços autogestionados*. Porto Alegre, Brazil: Panorama Crítico.

Mould Racing, or Ecological Design through Located Data Games

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Abstract

Can a complex site, such as an urban park, be better understood through a game? Might this playful preparation be useful for design? In response to such questions, this paper discusses a practical project that structured design-oriented site research as a development, implementation and deployment of a locative mobile game in which designers learn by racing colonies of virtual organisms. The analysis of this experiment demonstrates that this approach can support creativity and provide benefits compatible with goals of ecological design.

Aims and Questions

Ecology studies the reciprocal relationships between all organisms as well as between organisms and their environments. A subsection of this field, urban ecology can be defined as the study of how ecological systems evolve in cities. Ecological design is an outcome-oriented approach, informed by these fields of study, that aims to integrate human intervention with ecosystem processes, typically, to minimize the environmentally destructive impact (Van der Ryn & Cowan, 2007, x). More ambitiously, design can aim to orchestrate beneficial human relationships with other organisms in the built environment (Danilo & Steiner, 2011) . Ecological design is neither a linear process of master planning, characteristic of human design, nor a process of trial and error involving variation and selection, as they occur in natural systems, but instead is a coordinated process of dealing with unexpected turns via experimental practice (Gross, 2010).

An important ambition of related approaches to design is to deal with whole ecosystems rather than with discrete objects, e.g., cf. deep design (Wann, 1996), ecological design (Orr, 2002) or transition design (Irwin, 2015). Such systems are characterised by emergent and unpredictable events, they are complex, locally specific and prone to change.

To be effective, this type of designing needs to undergo a range of perceptual shits (DeKay & Bennett, 2011): 1) from objects to relationships to subject–object relations; 2) from analysis to context to analysis–context–ground; 3) from structure to process to unfolding; 4) from materiality to configuration to pattern languages; 5) from parts to wholes to holons; and 6) from hierarchies to networks to holarchies.

Fig. 1. The compound world 1: the procedural events of the virtual simulation can be experienced on-site and in the presence of others, through mobile devices. Top: players disperse at the beginning of the game. Bottom: explore the site.

Fig. 2. The compound world 2: players move through the shared site independently, linked by the conceptual structure of the game.

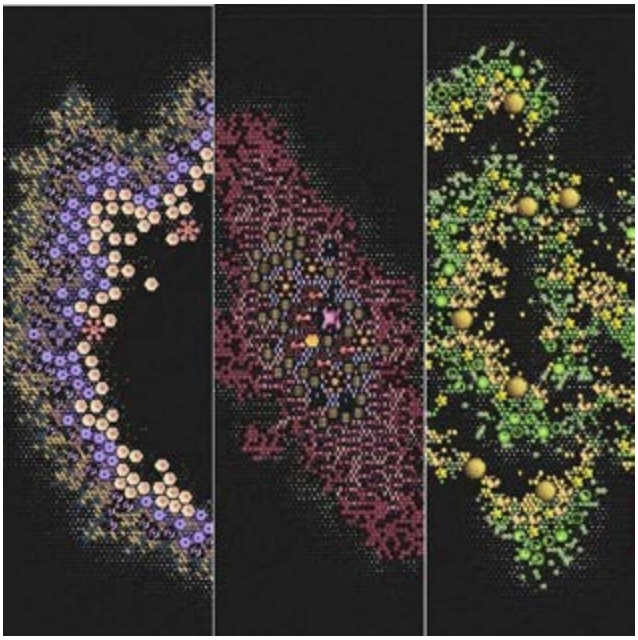

Fig. 3. Colonies 1: different types of cellular-automata growths in a context-free experimental environment.

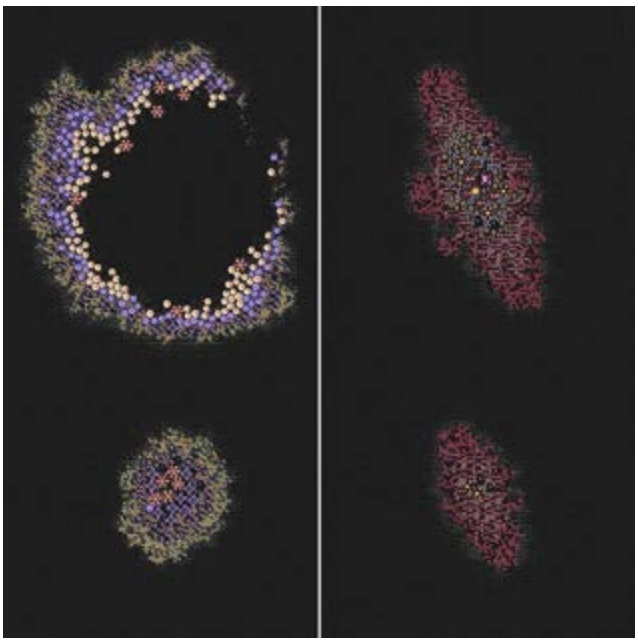

Fig. 4. Colonies 2: growth of two colonies with different aging rate and fecundity. Left: the Yellow expands quickly. Right: the Red colony grows more slowly.

In response, this paper proposes a contribution to an 'inspirational design environment' (Binder et al., 2011, 27–50) that can enhance such perceptual shits while informing them with evidence. Design environment is understood here as the totality of the circumstances that host the design process. In all contexts, but especially in ecological design, the design environment needs evidential input from a variety of heterogenous sources, including unusual stakeholders with differing knowledge systems. Participatory designing underpinned by the best of scientific knowledge become indispensable in engagement with ecosystems. How can scientific use of experimentation and experimental instrumentation inform the design process?

Experimentation is a method for uncovering surprising events. One particularly important example from applied, experiment-driven science is its use of epistemic objects. Epistemic objects (objects of knowledge) are abstract; they remain in continuous reconsideration and lack completeness (Knorr-Cetina, 2001; Rheinberger, 1997). This relative openness allows these objects act as catalysts for collaborative ideation.

This work extends the existing research on the use of visualisation technologies, interactivity and games 1) by using a game environment in support of ecological design and 2) by combining embodied experiences with generative simulations. The novelty of these contributions can be confirmed in reference to recent overviews of serious games (Laamarti, Eid, & Saddik, 2014; Lope & Medina-Medina, 2016) and to examples of recent work. The closest relevant category of the existing work can be defined as 'data games', or games where play involves engagements with real-world data, cf. (Friberger et al., 2013) or chapters 2–5 in (Nijholt, 2017). Existing approaches have attempted to 1) provide interactive access to visualised data to deepen understanding (Yi, Kang, Stasko, & Jacko, 2007); 2) encourage engagement by providing reward systems (Diakopoulos, 2011; Handler & Ferrer Conill, 2016); and 3) generate possible conditions by extrapolating from available data (Coulton et al., 2014; Dickinson, Lochrie, & Egglestone, 2015). The work presented here seeks to take such approaches further by supporting the design's job of imagining possible futures from unavoidably incomplete premises.

The paper presents its argument in application to a specific case-study. This case-study focuses on the design of urban landscapes, a challenge that makes explicit the systemic complexities that are also characteristic of other design problems. This case-study aimed to:

1. Deepen the understanding of the environment
2. Encourage creative participation
3. Expand the repertoire of design methods

Design Experiment

The case-study is a design experiment that focuses on a socio-ecological system of the Merri Creek parklands in Melbourne, Australia. In this experiment, the Merri Creek park is complemented by a virtual environment that incorporates a custom-written geo-referenced cellular-automata engine that is visualized as a navigable space (**Fig. 7–5**) and accessed through mobile devices, such as smartphones. This digital environment supports an ecosystem of virtual life where plant-like species spread in reference to spatially distributed affordances. These spatial distributions reference the geometries and materiality of the physical site reflecting its grassy fields, muddy river banks, asphalted vehicular roads and pedestrian paths.

The result is a hybrid 'design environment' that is enhanced with epistemic objects that are relevant to ecological challenges but are uncommon in design. Such an environment allows participants to simultaneously inhabit and interact with the physical site and the virtual datascape experiencing ideas through their bodies and on location.

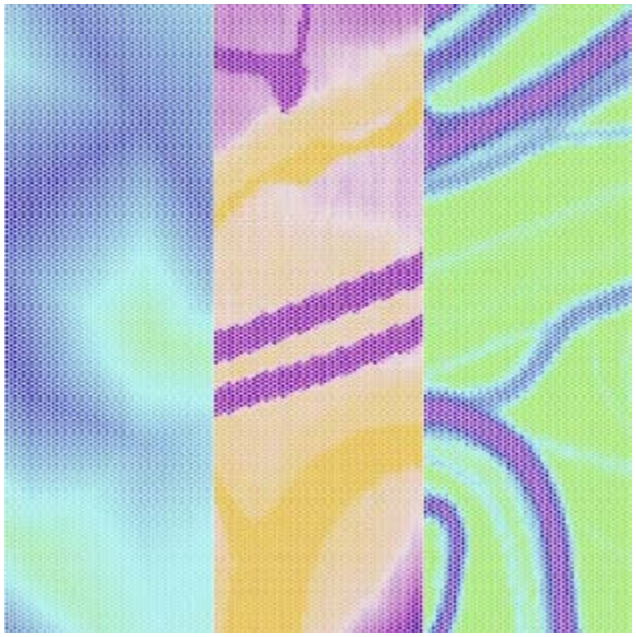

Fig. 5. Data maps 1: darker colours are cells with higher values. One map location is represented by different maps. Left: site moisture. Middle: ground permeability. Right: pedestrian movement.

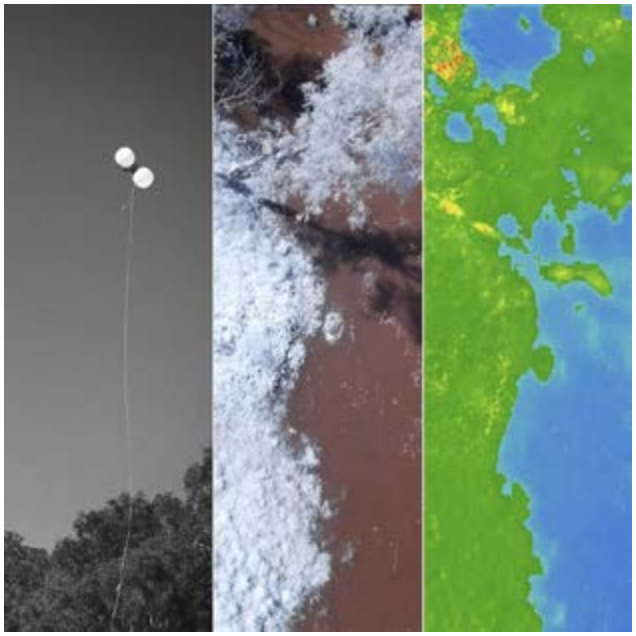

Fig. 6. Aerial mapping: left: balloon used in aerial mapping. Middle: an infrared image. Right: post-processing showing high photosynthesis activity in green.

Epistemic Object 1: Colony

In biology, a colony is composed of two or more individuals living in close association with each other. In design, an understanding of biotic communities such as colonies is important for their successful management. In response, the game represents the interactions between species, their environment and players as a range of properties (simplified here) that can lead to self-organization of these relationships into colonies.

The habitat properties are represented on a per-cell basis: 1) 'vegetation value' is the photosynthetic activity of vegetation, obtained through aerial near-infrared photography (**Fig. 6**), using balloons for elevation; 2) moisture is obtained from moisture sampling on site; 3) 'elevation' is the height above the sea level; and 4) 'ground permeability' expresses the amount and characteristic of ground cover, see **Fig. 4** for an example of distribution over the site. The organism properties are represented per species: 1) 'type' can be Red, Blue, Green or Yellow (**Fig. 3**); 2) 'age' can be: a) empty or dead; b) 'juvenile' (pre-reproductive); c) 'adult' (reproductive); d) 'senescing' (post-reproductive); 3) 'aging' can be faster in some species than in the others (**Fig. 4**); 4) 'reproductive success' varies between species and is influenced by their habitat; and 5) 'seeding' is based on probabilities weighted by habitat suitability. Player interactions take form of control over 'fertilisation': players can make the cell suitable to their species by physically traversing through them.

The growth pattern of the Green (right) results in (**Fig. 3**) with broken waves, in contrast to the continuous rings of the Blue (left). This pattern is a characteristic outcome of the low reproductive success and fast aging. Adult Green organisms are unlikely to seed into the surrounding empty cells before they become senescent and unable to reproduce. This process results in the characteristic gaps in its ring. In a more complex interaction (**Fig. 7**, left); a Red species grows along ground permeability gradients. It looks at the neighbouring empty cells and populates those sufficiently impermeable, resulting in a linear colony establishing itself along a length of road (**Fig. 7**, right).

This example demonstrated how an epistemic object 'colony' can be experiences through an interactive, located and embodied gameplay, leading to greater appreciation of the ecosystem dynamics and encouraging the shift towards the recognition of perceptual patterns of unfolding, as introduced above.

The subsequent discussion is divided into three parts that correspond to the key goals of the project introduced above.

Epistemic Object 2: Designer

In design, designer is a person that plans an entity prior to it being made. This is representative of well-recognised professional roles that ecological design aims to update and this project seeks to rethink design in terms of stewardship and redirection rather than explicit control.

In the game, designers, acting as players, are assigned a species. They can control growth of their colonies, but only indirectly. Player hold mobile devices that visualise the game state and record their location using Global Positions System. The game registers player's presence in a

cell and adjusts the properties of this cell, making it into a suitable habitat for the player's species ('fertilisation'). Thus, players' ability to act as designers is made contingent on their understanding of their virtual species and their bodily interaction with the physical site. In an example of an interaction shown in **Fig. 8**, a designer racing Green notices an emerging Blue colony in the muddy area on the far side of the creek (**Fig. 8**, left). Confident that high moisture is her rival colony's preferred habitat, she seeks to disrupt its growth by sprinting to the bridge, crossing the creek and moving towards the aggregation of the competing species. Her species will move along the fertilised trail she leaves and surround her competitor (**Fig. 8**, right). Without any empty cells to expand into, the Blue colony grows old and disappears.

This example demonstrates how the game exposes its players to a new interpretation of a familiar epistemic object 'designer'. Even though the game mechanics of this prototype are deliberately simple, the resulting cognitive effect do encourage the perceptual shift from an understanding of the designers as pre-planner to that of the designer as steward that sets conditions to encourage ecosystem events without controlling them directly.

Epistemic Object 3: Fragmentation

In ecology, habitat fragmentation is the emergence of discontinuities in an organism's preferred environment. These discontinuities, often caused by urban and agricultural development, introduce conditions such as gaps, islands and edges into a habitat, with significant impact on species and ecosystem health.

In the game, the consequences of fragmentation are experienced as constraints on gameplay. In one instance, participants were taking a break to discuss their experiences after playing the game several times. A player racing Red told the group how frustrated he was with his species, which only grew on impermeable surfaces.

As seen in **Fig. 7**, the player most often encountered his colonies spreading along the roads crossing the site, which he felt made them vulnerable. Many times, he saw competing colonies occupying the entire width of a road, leaving no room for his to expand. An instance of this can be seen by the Blue colony blocking the path of the Red in the top right of the figure (**Fig. 7**, top right). Another agreed, noting that rounder colonies seemed more capable of adapting to change than linear ones, which could easy be disrupted by blockages. These conversations illustrate a perceptual shift to a standard concept in science, 'fragmentation', and the newly acquired awareness of its network effects. From gameplay alone designer-participants were able to understand that edges had significant impact and proximity to or frequency of edges resulted in the reduced resilience of their colonies.

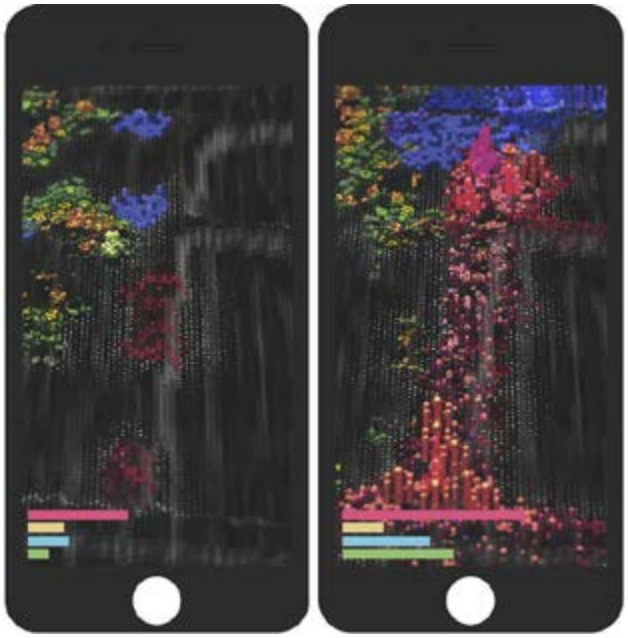

Fig. 7. Data maps 2: the simulated growths spread in response to the mapped data. In this instance, the Red colony thrives in concreted areas and can establish a large linear colony along a road cutting across the site.

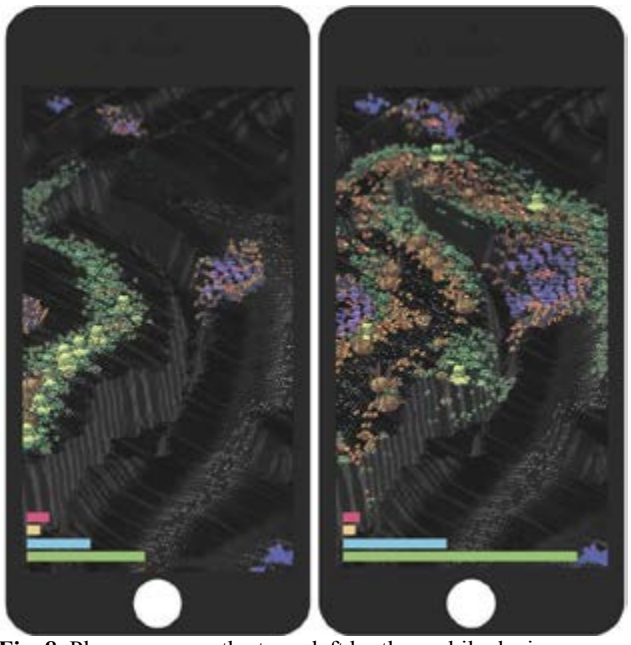

Fig. 8. Player agency: the trace left by the mobile device carried through the site affects the behaviour of the simulated growths. Here, a trace that runs across the bridge and through shrubs allows the Green colony to expand to both sides of the waterway, outmaneuvering a Blue aggregation.

Epistemic Object 4: Recruitment

In biology, recruitment is the process where juvenile individuals are added to a population. Continual recruitment is needed for an ecosystem to function as existing organisms senesce and die. Disrupting this process alters the composition of ecosystems, with significant future consequences. For instance, today's sustainable practices cannot bridge a gap left by low recruitment in the recent past, as can be seen, in the impeding massive loss of large old

trees and the subsequent losses in the many species that depend on them.

In one post-game conversation a player responsible for racing the Green colony asked if she could play Red in the next round. Though initially happy to race a fast-reproducing organism, she was now tired of ensuring that all her colonies had sufficient fertilisation for expansion. This player hoped that there would be less pressure to closely monitor the opportunities for recruitment when racing colonies of slower-growing but longer-living species.

This example demonstrates how an ecologically-relevant epistemic object, recruitment, can be derived from gameplay by a designer-participant that is not only ignorant about the relevance of recruitment but is unfamiliar with this concept before entering gameplay.

Design Environment

In this paper, the term 'design environment' includes the totality of entities such as objects, concepts and instruments that are involved in the process of designing and are recognized as its outcomes. In this context, the hypothesis of the project is that an arrangement of the design environment that aims to introduce problem-specific concepts and language while shortening the distance between design representations and designed phenomena can result in deeper understanding of the challenges at hand.

For the experiment, the site was limited to a 200m^2 section of the park. As characteristic of all sites, this location has been shaped by many simultaneous processes. Examples of these processes include economic needs of the city producing a highway overpass, cultural influences resulting in sporting facilities, cycling routes and scenic picnic areas as well as activities that aim to restore natural wetland systems after several decades of degrading industrial use.

Seeking to reflect these overlapping intensities, the test site is discretised as a 300x300 grid, which is then populated by layers of numerical information about the parkland. The experimental environment includes properties that are described in Epistemic Object 1. These data sets (**Fig. 4**) have been selected to demonstrate the possible diversity of data types, data sources and data quality, see Epistemic Object 1 for details. Varying formats, extents, consistencies and resolutions can be combined to create a compound virtual environment (**Fig. 1**). This capability is significant because it supports 'configurability' (Binder et al., 2011, 50) – an important characteristic of all inspirational design environments. The configurability supported by this approach can be particularly powerful as it integrates intuitions of human designers with diverse numerical evidence and direct on-site experiences.

This grid becomes a virtual world when populated by cellular-automata simulations of plant-like organisms. An instance of the world is initiated with several species, distributed according to weighted probabilities. Without external intervention by participants, organisms multiply into adjacent empty cells and establish colonies. Individual organisms within cells progress through an initial expansive period, a mature phase, and a period of decay leading to disappearance, see Epistemic Object 1. Colonies with different behaviours, properties and preferences emerge in response to parameters controlling this life-cycle, resulting in a rich and dynamic virtual landscape. The experiment discussed here featured four distinct types of colonies tagged by colour (**Fig. 3**), also see Epistemic Object 1. In response to the contextual conditions, these colonies might spread rapidly and then quickly die off, grow more slowly as clumps, exhibit observable spatial preferences, and demonstrate emergent, partially predictable behaviours.

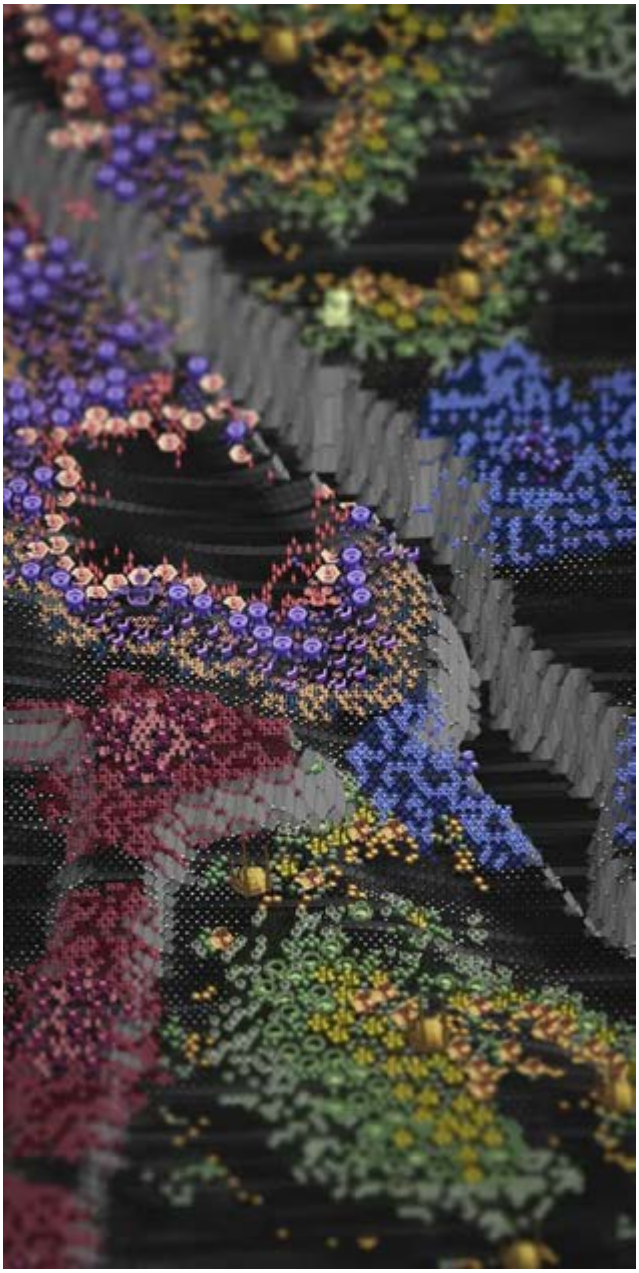

Fig. 9. Artificial ecology 1: the virtual system exhibits a hybrid ecology constrained by virtual and situated influences.

Each species is designed to prefer a spatial condition defined by the site properties. When a species is in its preferred habitat, its multiplication rate is accelerated. If all neighbouring cells are occupied, the colony has no place to expand and will soon die (**Fig. 11**). These rules support self-organizing growth patterns that can react to the site conditions in nonrepeating and surprising ways, without the need for pre-arranged and pre-situated events. This cellular-automata engine does not aim to simulate the site realistically. Instead, it emphasises the dynamic and incompletely controllable character of the design challenge, inviting reflection on the role of design and deeper engagement with the design situation. In this context, the simulation acts as an interpretative device that links heterogenous data sets, human expertise and immersive learning. These capabilities contribute to greater 'creative density' (Binder et al., 2011, 50), another important characteristic of inspirational design environments, by facilitating unexpected combinations of data and chance encounters at new locations, with its possible effects.

Simulations using cellular automate have been previously used to model urban or regional interactions. Even when they cannot reliably predict the future states, they are useful as devices that can map and visualise the scope of possibilities and link actions with potential consequences. The project discussed here sought to overcome the abstraction and the simplification that are unavoidable in computational models by narrowing the gap between the virtual and the physical worlds through the use of mobile devices.

Design Participants

This effect is achieved when the simulation is accessed on-site and experienced in parallel with the surrounding environment, fulfilling an important requirement of inspirational design environment that need to encourage holistic experiences to the 'genius loci' of target locations (Binder et al., 2011, 50). Prototype testing demonstrated new opportunities enabled by such embedding. For instance, this approach is useful for contextual assessment of available data. Incomplete or unevenly distributed datasets are common in practical situations. When a virtual environment informed by such data can be directly compared to on-site conditions, its quality can be more readily appraised and its import usefully reassessed, especially in the presence of other knowledgeable participants.

Dissonances between different forms of representations, interpretations and experiences can be beneficial because they disrupt habitual assumptions and encourage contributions for a broader range of voices thus supporting 'connectivity' – another essential component of the inspirational design environments (Binder et al., 2011, 50). To emphasize the virtual environment's capacity to support participative critical engagement and creativity, the access to the simulation is structured as a game. Within it, each species is represented by a set of geometries that change with maturity. The result is a visually rich world where relative states of each colony can be understood quickly and intuitively (**Fig. 7–Fig. 8**).

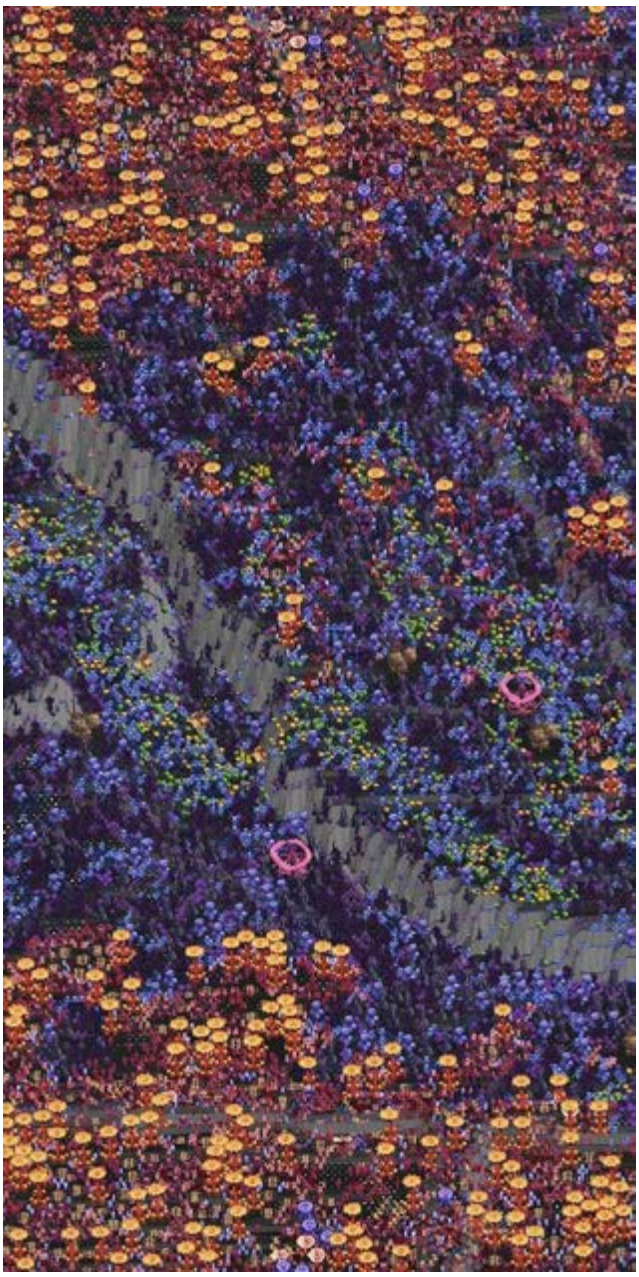

Fig. 10. Artificial ecology 2: one set of conditions (compare with the previous image) can result in substantially different ecologies.

Several players begin at the same time, in one location and are given control of one species in the simulation. The objective of the game is to make this species most populous. A round lasts ten minutes. Mobile devices show the state of the virtual ecology and the bar chart of the population numbers (**Fig. 7**). When a round begins, players quickly disperse searching for locations where their species might thrive. By physically moving across the site, players alter their location and intervene in its dynamics. Their trail leaves a residue that temporarily converts an empty cell into a habitat suitable the player's species, facilitating multiplication, see Epistemic Object 2 for an example.

Loosely structured, the game can be played in multiple ways. A group of three might decide to work with a single mobile device. Others form looser coalitions or rivalries: they observe each other but operate separate devices and are not aware of what happens on other participants' screens unless they ask. Each phone runs an isolated instance of the simulation but species behaviour, underlying data maps and site attributes are shared across instances, enabling comparisons, competition and cooperation, see **Fig. 2** for an example of parallel play.

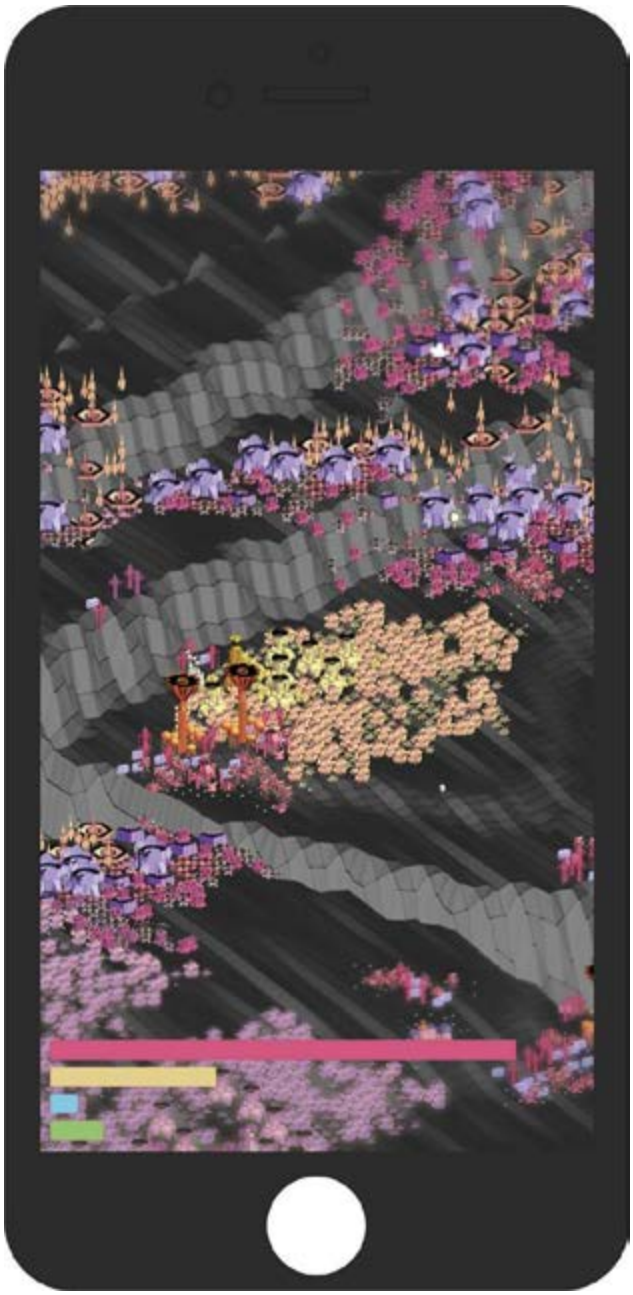

Fig. 11. Game event. Blocked on most sides by the Red, the central Yellow colony has limited room to expand. Without help from the player, it will soon die.

Once the ten-minute game cycle is complete the final population numbers are displayed (**Fig. 7**) and players return to the central point to discuss the outcomes. One person might complain that the Green easily overtakes the other species, with others nodding in agreement. Sometimes the initial seeding gives an advantage to a species. Another might pass her phone around, showing the Blue overwhelming everything else. Suggesting where they think each species grows best, some want to play another round – eager to see a new starting arrangement and test their just-acquired knowledge of the site. Everyone is allocated a different species, and another round begins. Cast as players, individuals are encouraged to take unusual actions within a shared structure that encourages them to compare and discuss their experiences and understandings.

The next section explores how such interventions can be used as methods to expand design beyond the creation of desired states and towards continuous and iterative negotiation of many forces characteristic of ecological design, see Epistemic Objects 3 and 4.

Discussion and Conclusion

The project's third objective has been defined as an attempt to expand the available selection of design methods, especially in relationship to such concepts as ecological design and its core principles: 1) place-specific solutions; 2) reliance on ecological accounting; 3) designing in partnership with nature; 4) inclusive participation; and 5) foregrounding of the natural processes (Van der Ryn & Cowan, 2007).

The goal of growing design solution from the specificity of concrete places is far from trivial as comprehensive understandings of what comprises such places are not readily available. The proposed approach has the potential to deepen and expand the place-specific research that typically occurs at the beginning of design.

The experiment has also demonstrated that situated simulations can contribute to integration of ecological accounting into design practices by providing a forgiving platform that can combine diverse datasets, provide an interpretative layer that can be compared to on-site conditions and motivate on-demand, ad-hoc data collection.
This commitment to deeper design research also contributes to the goals of design with nature and foregrounding natural processes that is further strengthened by deployment of simulation engines that can model real-world interactions. Deployment of such models can inform the initial, intensive stages of designing and be productive during the ongoing management of change. In addition, it invites design participants to reconsider their role in the design process by emphasising an understanding of designing as the continual negotiation of dynamic relationships rather than the creation of steady states.

In summary, the paper demonstrates the deployment of location-specific mobile games with integrated simulation of ecological process can lead to successful integration of important epistemic (knowledge) object from science and to relevant perceptual shifts in the disposition of participating designers.

Acknowledgements

The project was developed in collaboration with Kenny Ken-Li Chong, Tenglei Gao, Sai Huang, Eugene Jingwen, Femke Lokhorst, Siyu Meng, Jingsi (Carol) Sun, Brenda Tan, Xinyu Tan, Charlene Li Xia, Sibing (Emily) Yang, Nicolas Yepez, Yang Yucheng, Yujing (Shirley) Zhang.

References

Binder, T., De Michelis, G., Ehn, P., Jacucci, G., Linde, P., & Wagner, I. (2011). *Design Things*. Cambridge, US: MIT Press.

Coulton, P., Jacobs, R., Burnett, D., Gradinar, A., Watkins, M., & Howarth, C. (2014). Designing Data Driven Persuasive Games to Address Wicked Problems such as Climate Change. In A. Lugmayr (Ed.), *Proceedings of the 18th International Academic MindTrek Conference*, *18*, 185–191. Tampere, FI.

Danilo, P., & Steiner, F. (2011). *Urban Ecological Design: A Process for Regenerative Places*. Washington, US: Island Press.

DeKay, M., & Bennett, S. (2011). *Integral Sustainable Design*. London; Washington, DC: Earthscan.

Diakopoulos, N. (2011). Design Challenges in Playable Data. In D. Tan (Ed.), *Proceedings of CHI Conference on Human Factors in Computing Systems*, *8*, 1–3. Vancouver, CA: ACM.

Dickinson, A., Lochrie, M., & Egglestone, P. (2015). UKKO: Enriching Persuasive Location Based Games with Environmental Sensor Data. In A. L. Cox and P. Cairns (Eds.), *CHI PLAY '15, The 2015 Annual Symposium on Computer-Human Interaction in Play*, 493–498. New York, US: ACM.

Friberger, M. G., Togelius, J., Cardona, A. B., Ermacora, M., Mousten, A., Jensen, M. M., et al. (2013). Data Games. In J. Zagal, S. Björk and K. Hullett (Eds.), *Design Patterns in Games: Proceedings of the Procedural Content Generation Workshop at the Foundations of Digital Games Conference*, 1–8. Chania, GR: Society for the Advancement of the Science of Digital Games.

Gross, M. (2010). *Ignorance and Surprise: Science, Society, and Ecological Design*. Cambridge, MA: MIT Press.

Handler, R. A., & Ferrer Conill, R. (2016). Open Data, Crowdsourcing and Game Mechanics: A Case Study on Civic Participation in the Digital Age, *Computer Supported Cooperative Work (CSCW)*, 25, 2, 153–166. doi:10.1007/s10606-016-9250-0

Irwin, T. (2015). Transition Design: A Proposal for a New Area of Design Practice, Study, and Research, *Design and Culture Design and Culture*, 7, 2, 229–246. doi:10.1080/17547075.2015.1051829

Knorr-Cetina, K. D. (2001). Objectual Practice. In T. R. Schatzki, K. D. Knorr-Cetina & E. v. Savigny (Eds.), *The Practice Turn in Contemporary Theory* (pp. 184–97). London: Routledge.

Laamarti, F., Eid, M., & Saddik, A. E. (2014). An Overview of Serious Games, *International Journal of Computer Games Technology*, 2014, 11, 1–15. doi:10.1155/2014/358152

Lope, R. P. D., & Medina-Medina, N. (2016). A Comprehensive Taxonomy for Serious Games, *Journal of Educational Computing Research*, 55, 5, 629–672. doi:10.1177/0735633116681301

Nijholt, A. (Ed.). (2017). *Playable Cities: The City as a Digital Playground*. Singapore, SG: Springer.

Orr, D. W. (2002). *The Nature of Design: Ecology, Culture, and Human Intention*. New York, US: Oxford University Press.

Rheinberger, H.-J. (1997). *Toward a History of Epistemic Things: Synthesizing Proteins in the Test Tube*. Stanford, US: Stanford University Press.

Van der Ryn, S., & Cowan, S. (2007). *Ecological Design* (10th anniversary ed.). Washington, US: Island Press.

Wann, D. (1996). *Deep Design: Pathways to a Livable Future*. Washington, US: Island Press.

Yi, J. S., Kang, Y. a., Stasko, J. T., & Jacko, J. A. (2007). Toward a Deeper Understanding of the Role of Interaction in Information Visualization, *IEEE Transactions on Visualization and Computer Graphics*, 13, 6, 1224. doi:10.1109/TVCG.2007.70515

Authors Biographies

Stanislav Roudavski studies and designs technologically sustained places. His current practice-based research integrates organizational techniques of architecture, unpredictability and richness of performative situations, creative capacities of computing, visual languages of the moving-image arts, dramaturgy and spatial narrative.

Alex Holland works with kites, games, prison playgrounds and trees. He investigates the digital and physical characteristics of contemporary environments and the design opportunities arising at their intersection. Holland's current research looks at how techniques of computing can make contemporary design more participative.

Julian Rutten's research is situated at the intersection of culture, nature and technology. It explores how the concept of place evolves under the influence of technology. Rutten's qualifications include landscape architecture, mechanical engineering and robotics, deployed in the context of interdisciplinary design.

Kinetic Atmospheres and Immersion Architecture

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Keywords

atmospheres, architecture, interaction, movement, wearables, tactile-liquid vision, augmented virtuality

Abstract

This presentation extends the author's earlier work on dance technologies and in/audible choreographies to delve into participatory sensory architecture and augmented virtuality, introducing concepts of the material affects of textured, temperamental aural environments, and discussing the design of wearables used in immersive environments (kinetic atmospheres or 'kimospheres'). Kinetic atmospheres are conceived as formative, not built/constructed in a stable form but responsive to movers or even 'wearable' themselves. Basing its investigation of such porous interactive environments for wearable performance in recent installations of the DAP-Lab, as well as acoustic-theatrical installations and contemporary choreographic architectures and objects, the paper explores the impact of sonic and tactile wearables on movement and role-play within such kimospheres. Finally, it sketches more speculative developments of how bodies and wearables come to affect, and be affected by, kinetic, sonic and Virtual Reality interfaces – in the sense in which the composer Xenakis had envisioned reverberant multimedia architectures and spatial intensities to be live instruments, not static objects or envelopes. Birringer proposes to rework architectural, cybernetic, and hydrogeological theories of the *liquid*, and shift attention to liquid aurality and virtuality derived also from anthropological concepts of understanding the movement of water, mist, and vapor (immersion, animation, animateriality).

Kinetic Atmospheres and Immersion Architecture

Immersion is the term that has gained much currency in recent years. I believe its history, however, is one dominated by an ocular emphasis – visuality and visual stimulation also being of main importance in the world of computer gaming's POV and the increasing interest in Virtual Reality's immersive experience (across games and media industry, sports, health and medical sectors). From a holistic phenomenological and somatic perspective, such visual dominance is reductive, since our being alive to all divergent perceptions always involves movement, listening, sensing - a vast array of tactile information also coming through what philosopher Barry Smith has called our *uncommon senses* and conductive fibres, skeletal bones, flesh, skin and nerves of our nervous system (Smith 2017). Fred Moten embraces this array of the visual-spatial, aural and tactile, and listening to African American jazz musicians vividly evokes sexual and racial perceptions through *ensemble improvisation* (Moten 2013: 55). Moten's notions of an ensemble and of improvisational blurring of course take us into the heartland of theatre, dance and music. At the same time, one ought not to forget the manual dexterity and physical reflexes of gamers, their ability to focus and to anticipate. Anticipation and reaction play important roles in architectures of immersion.

Architectural thinking now also concerns itself with immersion, ambience and the atmospheric. Amongst current interdisciplinary studies of the atmospheric, theatre and performance art can be considered a heuristic paradigm within which social, material, legal or political elements of atmosphere resonate – even if only in a narrative or performative manner. Theatre and installation art can also be understood as a paradigm of the site or construction and operation of *atmosphere,* recently emphasized by architects and philosophers such as Juhani Pallasmaa, Peter Zumthor, Olafur Eliasson, and Gernot Böhme. If we look at many recent installations in museums

and galleries, it is obvious that theatres and art spaces today have shifted attention towards a relational and participatory poetics; they present themselves as potential testbeds of what Jean-Paul Thibaud has termed the 'affective tonality' of aesthetic experience. Böhme's writings on the aesthetics of atmospheres and the art of the stage set have been influential, in the background, regarding the more emphatic reception of *atmosphere* (and *Atmosphäre. Essays zur neuen Ästhetik* [2013] has just been translated into English).

In the following, I shall address the vibrational dynamics and resonances in a dance-theatrical installation. The poetry lines [Figure 1] are from the game "Red Ghosts" that can be played at a computer screen while the player listens to a recitation of the poem and scrolls the cursor along the lines. This game is set up as but one station in a larger theatrical architecture in which the real and the virtual merge, with the virtual complementing the real in a nearly tangible way as these realities are layered on top of and within each other. The layering invites and proposes different experiences for each audience member, creating a sense of their own emerging views as they construct a narrative. Ironically, the older theatrical term of augmented reality is now superseded by the notion of an *augmented virtuality* as it is promoted in the VR interaction design industry.

The poetry of the game is also an allegory, as it evokes the notion of slow time or slow evolutionary space, which was pertinent for the temporally extenuated experience we had devised for the theatrical environment of *kimosphere no. 4/Horlà*. I will therefore not touch upon games as such or VR technology, for that matter, but explore an expanded, multi-sensorial sense of playful immersion that my research, and my work as a choreographer, has sought to uncover through theatrical and architectural design.

Fig. 1. "Red Ghosts/Shadows of the Dawn," poetry video game, *kimosphere no.4/Horlà*, London, 2017 © DAP-Lab

Nevertheless, I give attention to the role of the virtual and of wearable VR heasdsets inside this design scenography, questioning their role and whether their inclusion was a good idea in the last instalment of the *metakimosphere* series (in 2017). Discussing it here will help to generate new questions and responses; the listener may have already found different solutions to what I would basically consider an isolating, insulating experience within the social theatrical – and often a ritual-communal – event. The isolating experience in question is the game at the computer screen, and the wearing of the VR-headset (goggles wired to a computer) or the lighter cardboard 3D headsets (with inserted iPhone) provided for our installation audiences. Visitors were invited to wander around a large-scale audio-visual and tactile landscape initially called "Red Ghosts/Shadows of the Dawn" – the ghosts in question being the eight speakers of an 8-channel sound installation, set upon tall stands, creating a tactile aural territory. Then there are the little ghosts of the Malagasy lemurs, the moonlit acrobats, evoked by our narrative subtexts about slow evolutionary history and migration. [Figure 2]

The sonic and tactile materials move these kinetic stories, disseminate them around the architecture of the whole, with voices, electronic sounds, echoes, processed natural sounds, distorted crackles and hisses, lights, mists, colors and moving textures. The 8-channel installation, with each speaker shrouded in a mosquito net suspended from the ceiling grid, in fact conjures a metaphorical or mythical forest of ghostly presences (three dancers, wearing masks, are hidden quietly inside this environment, still or barely moving), with dense layers of a sound-in-motion that is experienced by visitors while moving around the forest of speakers.

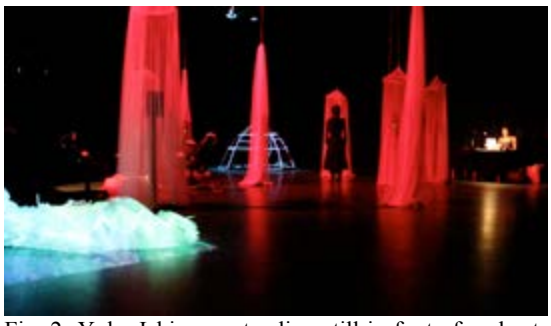

Fig. 2 Yoko Ishiguro, standing still in font of a ghost speakers; coral reef on the left, and sound artist Sara S. Belle performs in background right. Soundsphere skeleton visible in the back. *metakimosphere no.4/Horlà*, London 2017 © DAP-Lab

The micro-polyphonies in fact are only audible if they move across and between the nets, listening. The installation also has various stations on the perimeter, such as the VR interfaces just mentioned, as well as an igloo-like soundsphere where the visitor can crawl inside to

explore a GSR biosignal interface (listening to galvanic skin response turned into sound), and a "coral reef" sculpture where they can lie down and float inside a deep sea film projection that percolates over a synthetic origami architecture.[Figure 3]

The ritual-communal aspect of immersion and participatory art is an important concern, otherwise there would be no reason to experiment with these forms of liquid interaction. For many years of working in the theatre, it appeared quite satisfactory to create a dance or performance piece on the stage, for an audience to watch from the auditorium. But *atmospheres* of choreographic design suggest a new conceptual approach with which to pursue questions about sensorial immersion which change the older *dispositif*, asking audiences to step inside and come closer, touch, listen and act in greater intimacy with the unfolding action. [1] Such an approach to immersive dance, emphasizing a stronger kinaesthetic and multi-sensory affective impact on audience perception, has developed concurrently with an altered understanding of *digital embodiment* which has grown over the past decades, countering the so-called dematerialization of the art object, even if fluxus events and happenings, along with more ritual, psychedelic, or politically activist forms of performance had always existed within the vanguard traditions of modern art. The politicized and eroticized psychedelic happenings of the Living Theatre or of Carolee Schneemann's Kinetic Theatre of the 1960s provide an undercurrent for the more formal constraints that our immersive dance installations imply. [2]

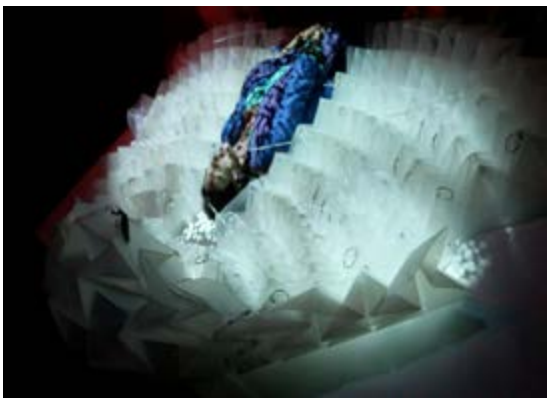

Fig. 3. Visitor floating inside coral reef, *metakimosphere no.4*, 2017 © DAP-Lab

The questions that interest us (in theatre as in architecture) concern the extended mode and model of performance with can contribute to other disciplinary studies of "atmosphere" (e.g. Gernot Böhme's writings on the aesthetics of atmosphere and the "art of the stage set"). A concern with atmosphere intersects with other overlapping sites of inquiry, including studies of mood, affect and histories of emotion, as well as ecocritical, climatological, and legal theory. Performance studies, like other academic or artistic inquiries, cannot avoid the complex and pressing ecological context of anthrogenic climate change, and its implications for what Böhme has termed "ecological aesthetics" (1993). DAP-Lab's *kimospheres* can thus be received in relation to these wider political and environmental concerns.

Since becoming involved in international co-productions of the European METABODY project after 2013, the new term I have used for our approaches is "kimosphere." [3] Kimospheres (kinetic atmospheres) are living, breathing spaces; not clearly definable or bounded, they are felt and perceived like weather, they flow, float, spread. One is corporeally present in them, moving through their *Stimmungen* (the German word *Stimmung*, similar to *Atmosphäre*, implies in its etymological origin also *Stimme*, i.e. voice, an acoustic experience, a tuning), perceiving-listening to the relational, dynamic and metastable states of such atmosphere. As designed spaces, kimospheres are installed, thus "built" and choreographed for visitors, and they often focus on audio-visual and material-sculptural or fabric configurations.

They are also informed by the developments of embodied interaction in dance and digital media – dance that incorporates technologies and associates its compositional ideas with software programming (mathematical and abstract languages). Earlier multimedia work I had created took place on the stage (or, telematically, on screens); thus it was projected for audiences, not designed to be entered by them, unfolding and pulsating close up. Breathing in and touching thus also closely connect the atmospheric to listening-sensing. Atmospheres are sensed, and if you imagine walking in a forest or unfamiliar urban territory at night, you will be listening to the atmosphere and the not-seen, to imperceptible movement. You become more succinctly "attuned" to the environment since you are hyper-activating your survival instincts and peripheral senses.

From projection to (virtually) embodied immersion – this is not necessarily a shift as projections may still remain a part of the installation architecture. 3D film or VR remains a cinematic projection medium, yet it has enhanced its plasticity and the illusion of absorption (of the viewer feeling being inside rather than looking from the outside in). 3D interaction designers emphasize that such absorption – and what our collaborator Doros Polydorou refers to as "the perception of being

physically present in a non-physical world" – relies on the *plausibility illusion,* namely that you are not only using your body to perceive in the way you normally do, but that the environment believably responds to your actions to make you think it is real. [4] DAP-Lab's research on formative and wearable space, on a mediated and yet highly visceral environment that is not constructed in a stable form but evolves through movement, now provides the basis on which I reflect current ideas and practices of immersion-dance, perhaps also questioning those notions of plausibility. Movement, in this sense, can also include the motion of light and graphic projection, the diffusion of sound waves, energy fields, color fields, edgespaces and anomalies, and various forms of embedded *motion sensing* which result in inter-agential reactions (in the environment).

If one were to embrace an even larger notion of the environment, say, an ecological and hydrogeological sense of infrastructures that may not even be visible and sensorially directly experienceable, the wearable becomes abstracted or, rather, shifts into more imaginary affective tonalities and synaesthetic resonances evoked by liquid materialities (e.g. underground water, mist, vapor, fog, blurred light, atmospheric pressure). The hyperarchitectural case study that has been pathbreaking, in this respect, is Diller + Scofidio's *Blur Pavilion*, a suspended platform shrouded in a perpetual cloud of man made fog (water droplets sprayed through steel jets) created for the 2002 Swiss National Expo and installed on the lake at Yverdon-les-bains. After walking or cycling down a long ramp, visitors would arrive on a large open-air platform at the center of the fog mass; the only sound heard was the white noise of pulsing water nozzles. Computers were adjusting the strength of the high-pressure spraying according to the different climactic conditions of temperature, humidity, wind speed and direction; thus the fog mass changed from minute to minute. It is hard not to remember here also John Cage's meditations on sound as weather, as boundless, ephemeral and undefined materiality, as flows and imaginary landscapes beyond music.

Flow and movement, in fact, are the primary poetic and phenomenological key to architectural philosopher Wolfgang Meisenheimer's *Choreography of the Architectural Space (Choreografie des architektonischen Raumes),* especially in the chapters on "Gestures of Places" and the threshold phenomena of the gestures of "Passageways." I discovered Meisenheimer's book in the architecture section of a museum bookstore during an exhibition on fashion and architecture. What impressed me particularly were the highly evocative black and white photographs of butoh dance and gestural choreography that intersperse his incisive reflections on ambiguous thresholds enabling movement "from the outside to the inside, from the inside to the outside" – what he calls the disappearance of space in time. The book was published in three languages (German, English, Korean) and is an enticing visual art work in itself, gesturing at what we could consider a form of performance-writing, but also hinting at the bridging – the entanglement of the material and spiritual worlds.

The animative effects of augmented virtuality are only now being tested and explored in the arts and in some work by anthropologists (c. Andrea Ballestero's study of aggregation and collective care). Caring for the environment and listening to its visible and invisible flows, I argue, becomes an important part of our understanding of the sensing the wearable, and of crossing between worlds.

Figure 4. *Metakimosphere no. 4.* Visitor [left] enacting/embodying what she perceives inside "Lemurs" interface with VIVE headset (conducted by Doros Polydorou), 2017 © DAP-Lab.

This underlying idea of an expanded choreographic field suggests a technologically infused dance or, rather, a material-sensory practice filtered through fashion and expanded sculpture. Movement and fashion design for our wearables are understood by DAP-Lab to be choreographic as well as architectural, examining how costumes are *immersive and shareable,* and what concepts of the *wearable* allow – for example a double wearabilty, both of our specially designed garments and yet along with the wearability of space – the choreography of architectural scores.[5] The sensorial environments that I describe are also sometimes refered to as "choreographic objects" (e.g. the installations by William Forsythe, and also William Kentridge's kinetic and immersive multimedia installations, such as *The Refusal of Time,* 2012, or the more recent *O Sentimental Machine,* both shown at London's Whitechapel gallery in 2016), but in our case it is more pertinent to think of the fluidity of atmospheres rather than objects.

In conclusion, the notion of a fluid "immersive dance" needs to qualified in so far as I notice an increasing reduction of our dancers' activities or, rather, a shift towards a different role regarding the interactional invitations of the kimospheres to the visitors. This became clearer in *metakimosphere no. 4* (2017), where our dancers relinquished dancing altogether. It was the visitors who were invited to move through the parcours, at their leisure, and explore tactile and auditory experiences while at the same time being challenged into somatic (inner) bodily sensations afforded by the new kinetics of augmented virtuality. With *metakimosphere no. 4,* DAP-Lab for the first time fielded proto-narratives, composed through an 8-channel sound installation (Red Ghost Speakers) and five interface stations that each intertwine aspects of two narratives (*Horlà*, adapted from a short story by Guy de Maupassant; *Shadows of the Dawn*, adapted from a field report on lemurs by primatologist Alison Jolly in Madagascar).

Their exploration is the choreographic process: it includes intimate personal (meditative) resonances derived from the floating "coral reef" and the "Red Ghost" poetry game. There are two VR interfaces where visitors enter ghostly worlds via goggles. M*etakimosphere no. 4* thus combines two atmospheres, a real architectural space and a virtual (computational) space, both actuated through the same tactile narrative, neither perhaps completely plausible. The critical aspect for us is the immersant's sensory participation: the resonances of real and virtual spaces are to be rhythmically entwined.

The occurrent gestures are envisioned to become reciprocal – pushing the kinaesthetic into a perceptual virtuality (VR) that so far is largely contained in the visual (the ergonomic challenges with virtual reality headsets are well known: the more powerful headsets must be tethered by thick cables to computers or consoles), yet also provides tactile and synaesthetic affects. These are feeding the virtual "play" back to the corporeal, pouring it back into the player's gestural action (see Figure 4) even if our playfully physical interface can tangle up immersants' legs when the rigs occlude their view of the real world. The kinematic, then, is the challenge for a social VR choreography which does not insulate/isolate the immersant but allows for an expanded synaesthetic perspective and embodiment where imagined full-body perceptual virtuality feeds back into the kinaesthetic. The momentary insulation from other visitors or friends, during the installation, turned out not to be a problem: everyone seemed patient, waited their turn, observed, and even chatted and commented upon one another's "choreography" of following into the lemurs' forest, trying to catch a glimpse of the moonlit acrobats. A knowledge exchange, right there on the spot.

This requires a process where the virtualizing instrument is not perceived as an enclosure-object or prosthesis but as a wearable that becomes a part of the body as a metamorphic process and hyperobject. The immersant dances, so to speak, with the instrument, moved with it (or even draws with it, as we tested when we switched the VR dispositive into the Google Tiltbrush mode). Given the precarious experience of a technological body or technical being that is mutable and relational, movement becomes a vector of affect. The immersant can enact, or fail to enact, specific bodily gestures or movements: there is no correct way of executing a particular movement but only actualized potentials (virtuals) derived from resonant narrative or kinaesthetic stimulation. The sensory stimulation is more complex when one works to augment the virtual reality with a textured floor surface, say a "forest ground" that actually consists of grass, moss, leaves and small twigs. The immersant steps onto and into an earthy interior-exterior world, where substances and media intermingle, and where bare feet, for example, could touch the "ground" in a new tangible way while the virtualizing instrument evokes the Red Island and its lemur population. "Dancing" in such augmented virtuality can let movement become unleashed from the rhythm of sound, vibration, graphics, colors and light produced by the engineered atmosphere, real and 3D digital. It is another kind of dancing, perhaps a leap into something we may anticipate in the visual and auditory feedback world of cinema – where our affective and sensorimotor reactions are deeply stimulated by the movement-images – whereas kinaesthetic empathy in the theatrical auditorium tends to be more contained due to the conventional separation of stage and audience.

The immersant performer adopts and crafts the instrument of the relational contexture. Movement and sensation in kimospheric environments are interdependent threadings, and the installations we build tend to mesh numerous fabrics so that one can also think of the atmospheric as an open, interlaced fabric or meshwork along which the visitor travels. It is in this sense that the visitor is no longer audience but protagonist within an environment that is also co-active. "Embodiment" is an ambitious term in such immersive augmented reality, and Böhme certainly touches upon the mystical when he writes of the "ecstasy of things" that touch us in the atmospheric aura.[5] In a future work that we plan (*Ephemeral Edgespace*), especially in collaboration with Haein Song's shamanic ritual kut performance practice that will open up new

pathways to atmospheres of healing and care, the commingling ecstasies of performers and things will be threaded and explored. More modestly, the last version of the *kimosphere* is, on one level, an exploration of light and what is (still) discernible in the dusk when contours begin to dissolve – the mesmeric light *entre chien et loup*, as French cinematographers call it. This space of the lemurs is perhaps an ideal space for the potential virtual, especially of the not plausible kind.

References

[1] The first experiment by DAP-Lab with the immersive form was created in UKIYO (2009-2010) when I designed an open space criss-crossed by five *hanamichi* on which the dancers and musicians performed while the audience was free to walk around and across the space in whatever way they liked. Visitors often came very close, inches away from the dancers who wore specially designed audiophonic costumes (wearables) created by Michèle Danjoux, DAP-Lab's fashion director. For a film excerpt, see: https://youtu.be/g2yfYrlvOLM. DAP-Lab now also collaborates with Korean kut choreographer Haein Song on the intersections of atmospheres and ritually animative spirit worlds

[2] I am tempted to use the French term *contrainte,* referring to the deliberate constraints that George Perec and the artists of the OuLiPo (Ouvroir de Littérature Potentielle) used for their compositions, as it associates the virtual (*potentielle*) and also describes well the function of our wearables and costumes in DAP-Lab performances, which are constructed as stimulus and encumbrance that invite/require new and unpredictable movement possibilities. See Birringer 2017. Regarding kinetic theatre and the erotic, the retrospective of Carolee Schneemann's art at Museum für Moderne Kunst Frankfurt ("Kinetic Painting," May 31 – Sept. 24, 2017) gives ample evidence of her radical expansion of "painting" into performative actions (e.g. *Meat Joy,* 1964) that were highly tactile, plastic, palpably fleshly and also deliriously messy.

[3] METABODY was initiated in Madrid (July 2013) by a collaborative network of arts organizations, research labs and performance companies engaged in a provocative rethinking of perception and movement away from the mechanistic and rationalistic tradition, and thus also the dominant western tradition of visuality or ocularcentrism combined with formal and systemic 'built' environments and protocols that take certain embodiments for granted, towards a (digital) embodiment that puts emergent differentials of bodies and affects in the forefront of its concerns. METABODY was coordinated by Jaime del Val (Asociación Transdisciplinar Reverso) and comprised eleven primary partners including DAP-Lab, STEIM, Palindrome, K-Danse, InfoMus Lab, Stocos, Hyperbody Research Group, and Trans-Media-Akademie Hellerau (http://www.metabody.edu). DAP-Lab wishes to thank partner artists in the METABODY project for the knowledge transfers, especially Nimish Biloria and Jia Rey Chang (LOOP Pavilion) and Hyperbody master students who worked on a computationally generated origami pattern based surface with integrated lighting, motion capture and robotic actuation: the *{/S}caring-ami* team gave us polypropylene materials to create new wearables. Michèle Danjoux's ideas for conductive wearables and proximity-sensing performance evolved from working with Jonathan Reus during the e-textile lab at STEIM (October 2014); my scenographic sketches for "kinetic atmospheres" originated in early 2015 during the first public presentation of *metakimosphere no.1*. I thank all dancers who collaborated on the exhibitions: (http://people.brunel.ac.uk/dap/metabody.html and http://people.brunel.ac.uk/dap/kimosphere4.html/).
Core elements of *kimosphere no. 4* include 8-channel sound design by Sara S. Belle; "Red Ghosts" and "Horlà" cut cup poetry by Emma Filtness; "Shadows of the Dawn" cut up by J. Birringer; performance by Yoko Ishiguro, Helenna Ren, Haein Song, and Sara S. Belle; biosignal interface by Claudia Robles Angel; *Horlà* 3D film by Paul Moody; "Red Ghosts" game by Ashley Rezvani; coral reef projections by Chris Bishop and J. Birringer.

[4] Doros Polydorou's "Embodiment in Virtual Reality" presentation was made during a Symposium on *Immersion/Presence*, May 27, 2017, preceding the premiere of *kimosphere no. 4/Horlà* at Artaud Performance Centre, Brunel University London.

[5] Böhme 2013: 33. See also Zumthor 2012; Pallaasma 2014.

Bibliography

Birringer, Johannes (2017) "Audible and Inaudible Choreography: Atmospheres of Choreographic Design," in Sabine Kaross and Stephanie Schroedter, eds., *KlangSpuren/SoundTraces*, Bielefeld: Transcript Verlag, 121-42.

Böhme, Gernot (2013) *Atmosphäre. Essays zur neuen Ästhetik*, Frankfurt: Suhrkamp.

Böhme, Gernot (2016) *The Aesthetics of Atmospheres: Ambiences, Atmospheres and Sensory Experiences of Spaces*, ed. Jean-Paul Thibaud, London: Routledge.

Danjoux, Michèle (2014) "Choreography and Sounding Wearables," *Scene*, 2:1&2, 197-220.

DAP-Lab (2010) *UKIYO (Moveable Worlds),* dir. by Johannes Birringer and Michèle Danjoux, Sadler's Wells, London. https://youtu.be/g2yfYrlvOLM.

Diller, Elizabeth and Scofidio, Ricardo (2002), *Blur: The Making of Nothing*, New York: Harry N. Abrams.

Meisenheimer, Wolfgang (2007) *Choreography of the Architectural Space,* trans. Rebecca L. van Dyck and Kim Jeong-Geun. Munbal-li : Dongnyok.

Moten, Fred (2003) *In the Break: The Aesthetics of the Black Radical Tradition.* Minneapolis: University of Minnesota Press.

Pallasmaa, Juhani (2014) "Space, Place and Atmosphere: Peripheral Perception in Existential Experience," in Christian Borch, ed., *Architectural Atmospheres: On the Experience and Politics of Architecture*, Basel: Birkhäuser, 18-41.

Philippopoulos-Mihalopoulos, Andreas (2015) *Spatial Justice: Body, Lawscape, Atmosphere*, London: Routledge.

Polydorou, Doros (2017) "Embodiment in Virtual Reality" , paper presented at *Immersion/Presence* Symposium, Artaud Performance Centre, Brunel University London. May 27.

Smith, Barry, with Nick Ryan (2017) "The Uncommon Senses," BBC Radio 4 program.

Author Biography

Johannes Birringer is a choreographer and media artist; he co-directs the DAP-Lab at Brunel University where he is Professor of Performance Technologies in the School of Arts. He has created numerous dance-theatre works, video installations and digital projects in collaboration with artists in Europe, the Americas, China, and Japan. DAP-Lab's interactive dance *Suna no Onna* was featured at festivals in London (2007-08); the mixed-reality installation *UKIYO* went on European tour in 2010. The dance opera *for the time being* was shown at Sadler's Wells, 2014. A series of immersive dance installations, *metakimospheres*, began touring in Europe in 2015-17 as part of the Europe-wide METABODY project. He authored *Media and Performance* (1998), *Performance on the Edge* (2000), *Performance, Science and Technology* (2009), and transdisciplinary research projects, including the books D*ance and Cognition* (2005), and *Dance and Choreomania* (2011). He is editor of "Sound in Performance" for *Critical Stages* #16 (2017).

Augmented Abstraction

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Abstract

In this paper we present the creative process of the art installation, titled "Augmented Abstraction", [1] in which the previously established and accumulated knowledge about abstract painting acquires new aspects by means of its translation through the digital media and AR (Augmented Reality) computer technology, and involvement of the audience in the process. The key challenge of the installation is *to detach color (sensations) from form (representation) and make the creative process aboveboard i.e. to deal openly to the audience.*

Subject of this paper as well as of the installation is the interspatiality in art, the new understanding of human presence, inhabiting both the real (uncomputed, corporeal, actual) and virtual (computed) worlds at the same time. The objective is to investigate and point out some of the new aspects to the concept about image as a secondary manifestation of the primary vehicle of creativity – the abstract code, emerging from the interaction between the virtual objects and the real world.

Keywords

Augmented abstraction, virtual reality, mixed reality, perceptual capabilities, image, code.

Introduction

We have been witnessing many times in the art history concepts that are striving to get beyond our perceptual capabilities. Nevertheless, with the arrival of the digital media and computer technology, and in particular of the *Augmented Reality (AR)* as part of the *mixed reality (MR)*, we can talk about new state of the mind, new radical change of our optical perception and consciousness. Roy Ascott, talking about "cyberception", explains such technology as a new understanding of human presence. "To inhabit both the real and virtual worlds at one and the same time, and to be both here and potentially everywhere else at the same time is giving us a new sense of self, new ways of thinking and perceiving which extend what we have believed to be our natural, genetic capabilities" (Ascott, 1994, para. 1). AR technology is giving us new approach to the pictorial space by eliminating the frame and creating a new 3D putative environment.

Subject of the art installation, as well as of this paper is the inter-spatiality in art, the new understanding of human presence, inhabiting both the real (uncomputed, corporeal, actual) and virtual (computed) worlds at the same time.[2] In order to approach the topic in a more comprehensive manner, I have also studied some of the preceding concepts that are striving to get beyond the fixed point perception. The objective is to investigate and point out some of the new aspects to the concept about *image as a secondary manifestation of the primary vehicle of creativity – the abstract code*, emerging from the interaction between the virtual objects and the real world.

The actual whole – nude painting (material nude) viewed in the mode of everyday visibility, is first digitized, converted into a digital form that can be processed by e computer. Later on, the digitized painting is translated into abstract augmented image, allusive or completely nonobjective. The audience is directly involved in the process by activating the augmented reality. By using the AR technology, the art installation is giving chance to observe simultaneously the material world (physical, real-world or its representation in

[1] The project was shown on the 56th edition of Ohrid Summer Festival, July-August 2016, Ohrid, Macedonia.

[2] The art installation and the concept behind it adheres to Joseph Nechvatal's art theory about "Viractualism", contemporary art movement where the artist operate within the inter-spatiality between the computed (the virtual) and the uncomputed corporeal (the actual).

the mode of everyday visibility) as well as the virtual elements which exemplify the abstract code.

The article titled "The Matrix of Sensation" by Prof. Donald Kuspit, published in "Artnet" magazine (Kuspit, 2005) has been inspiring for the project in a really profound way. Prof. Donald Kuspit, talking about Michael Somoroff's digital video "Query" is giving a serious theoretical base for further experimentation with the digital media, and more specific with digital painting and augmented reality. The result of the installation "Augmented Abstraction" matches Prof. Donald Kuspit's theory about sensation saturated digital representation – codification of the material nude (viewed in the mode of everyday visibility) in an intellectual epiphany. That is the heavenly nude which is more beautiful and perfect then the earthly nude.

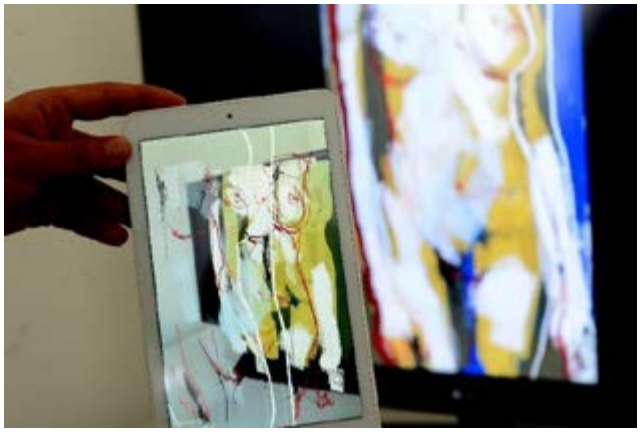

Figure 1: Sample image of the art installation, 2016. The augmented reality system used in the installation is simple, designed to create immersive environment simulated by computer. After detecting the marker (which is digitally painted nude depicted in a mode of everyday visibility and displayed on a large TV screen) the AR system running on a tablet PC augments each of the painting layers, hence detaches and offsets multitude of abstract color shapes into various combinations, creating complex permutations. The actual whole is translated into abstract AR image, allusive or completely non-objective, and the audience is directly involved in the process by activating the augmented reality.

Going Beyond the Perceptual Capabilities

In this section I will briefly mention and point out some of the *crucial foundations upon which this installation and study are grounded*.

Byzantine art, in particular its spatial organization is something that provokes extremely opposed attitudes among the art historians. There is opinion coming even from real connoisseurs explaining the space and perspective in the orthodox art with naivety and primitive quality of the art. Nevertheless, there is also theory explaining this "transgressions" against the laws of linear perspective as not fortuitous, but as "a special system for the representation and perception of reality" (Florensky, 2002, p. 202). That is why Byzantine art sometimes could be compared to some of the contemporary artistic languages – there is a highly stylized depiction of space and figures. The church doctrine includes a possibility to depict the divine glory with a medium deeply inherent to art.

Clemena Antonova, in the conclusion of the paper "Visuality among Cubism, Iconography, and Theosophy: Pavel Florensky's Theory of Iconic Space", explains that "in many ways, theosophical concepts formed the bridge between Orthodox iconography and modernism. This is especially true of the similarities in the construction of pictorial space in Cubist images, on the one hand, and in medieval painting on the other" (Antonova 2012, p. 10). Talking about the Russian avant-garde, according to Antonova, it is most obvious that the rediscovery of the icon contributed directly for development of modern art. Theosophical thought was used in the explanation of the modernism i.e. what would be the relation with the space in the medieval icon. Kasimir Malevich, one of the most important Russian avant-garde artist of 20th century, from early age was exposed to orthodox iconography, even he painted icons. Familiar with the icon aesthetic and spatial orthography, and Influenced by the neo-primitivism movement, later he was painting in a style called Cubofuturism. The name of the movement shows his inspiration clearly: Italian futurist engagement with motion, and French analytical cubism. But it stands to reason that the main catalyst for his artworks is the strong relation with the system of spatial depiction of the orthodox iconography. In his cubo-futuristic artworks, it seems like he took a scalpel to the time itself, showing multiple-vanishing point perspective, and simultaneously depicting different angles of view. In general it is obvious that Theosophy is the creative revelation for all of the modern artist and thinkers at the beginning of 20th century. "What is specific to the Russian case, however, is that Theosophy entered an already on-going discourse on the medieval image" (Antonova 2012, p. 3).

The so-called Astral Vision in Theosophy means "higher dimension of existence", developing a perception that discloses the transcendental and infinite in the material and finite. This will lead to completely new method of perception of the visual world, new approach to the pictorial space, more subordinate to the idea and meaning, counteraction to the prevalent Renaissance and postRenaissance rational, representational art. The artworks of Cezanne are the predominant influence leading towards the geometrical simplification of Picasso and Braque. Cubists were interested in finding depicting method that goes beyond the conventional ways of representing space, transcending the

rules of linear perspective. That is why the forms in their paintings have been extremely fragmented into a planes that seem to move outwards towards the spectator instead of inwards towards the vanishing point (Honour & Fleming 2010). The division of the object into parts becomes a necessary element, representing the object from several points of view. This is the fundamental feature of the cubistic spatial organization: representation of parts and surfaces of the same object which cannot be seen simultaneously from a fixed position.

Furthermore, Picasso experimented with Cubist sculpture as well, constructing objects being flat yet not quite flat, half spatial and half solid, decorative yet austere and harsh (Honour & Fleming 2010). This goes one step further from the Cubist painting, giving chance to experience the effect of the "astral vision" in a real, 3D space. His attempt to expand the Cubist image in 3D space could be perceived as an attempt to reorganize the space itself, to reorganize the fixed point perspective system into a new 3D presumed environment. Sure enough, this is attempt to avoid the conventional optic models and the conventional perception of space, seeking for advanced awareness through a nonlinear extended consciousness.

Next I would like to discuss *the immersively suggestive painting of Jackson Pollock*. Abstract Expressionism goes in a direction in which color in itself is subject matter enough, resulting in paintings overflowing with expression, feelings and emotions, and at the same time emphasizing the spontaneity of the painting process. Abstract Expressionism took many forms, for this occasion I would like to point out one of the leaders of the movement, Jackson Pollack. His method of "dripping" paint on to canvas laid on the ground, resulted with the new important element – the action, or the gesture of painting. He is not touching the canvas with the brush, but stood over it and pour and spatter the paint, often resulting with large sweeping patterns, and giving a sense of inconclusiveness and limitlessness. When standing in front of his "portable murals", extremely large canvases, the audience has feeling like being immersed in it, while observing from one whirlwind of color to the next. The patterns of color poured from edge to edge across the huge picture field, seems like expanding into infinity beyond the painting itself. The audience gaze is constantly shifting from foreground to the background, as if observing some "atomic explosion".

I found confirmation about the importance of the abovementioned aspects of Pollock painting in Joseph Nechvatal theory of immersive consciousness, "based on a broad inquiry into the histories of virtual reality, philosophy, and the visual arts". In his study "Immersive Ideals / Critical Distances – A study of the Affinity Between Artistic Ideologies Based in Virtual Reality and Previous Immersive Idioms", Nechvatal explains Pollock painting as an example of immersive tendency, artworks that seek to draw the observer into the canvas, "not by establishing a distant vanishing-point, but by conceptually eliminating the frame so as to permit the eye to follow the curvilinear patterns beyond the canvas and into the implied surrounding space without being stopped by the edges. Here the intention was to create paintings *without beginning or end* as the vastly increased size of the canvas and its elimination of the traditional frame produced an effect suggesting the ideal immersive 360° optic bubble… The painterly consequences, with their incredibly rich eidetic depth, are immersively suggestive of further immersive spaces and states of mind. This proposal of an oppositional counter-tradition to geometrical perspective places Pollack in a key position to bolster immersive-holonetric consciousness" (Nechvatal 2009 pp. 311-13).

Mixed Reality and Viractualism

All of the abovementioned examples are result of the *desire to transcend the boundaries of our customary human cognition*. Nevertheless, only with the arrival of the digital media and computer technology, and in particular of the *mixed reality (MR)* we are in front of a remarkable change of our optical perception and consciousness. By mixing the real and virtual worlds, a mixed reality system results with superior environment, in which computed (virtual) and uncomputed (corporeal or actual) co-exist and interact. I believe this is bringing us in front of the next important art history watershed.

Mixed reality is in-between the real environment on one side, and *virtual reality (VR)* on the other side, containing in itself the subcategory of *augmented reality (AR)* (Siltanen 2012).

Virtual reality is explained as an immersive environment simulated by a computer. The system is changing the reality, hence the perception of reality is manipulated. The main advancement would be the interaction between the system and the user i.e. the user can explore the manipulated, immersive environment from a personal computer. Central subject to the most of Nechvatal's research is *immersion* – experience deeply inherent to the virtual reality, as well as the newly emerging *immersive cultural consciousness.* Nechvatal explains the immersive art as a temporary realization of the desire to exist in an anti-mechanic state of expansion, meta-symbol of and for expanded human potential. Furthermore he explains interactivity not as an ability to manipulate and modify the virtual world, but essential ability of the immersant to self-modify (self-reprogram) his/her sense of self (Nechvatal, 2001). As I mentioned before, the art installation "Augmented Abstraction" and the concept behind it adheres to Joseph Nechvatal's art theory about "Viractualism", contemporary art movement where the artist operate within the

interspatiality between the computed (the virtual) and the uncomputed corporeal (the actual).[3] In the art installation "Augmented Abstraction" this fusion between the computed, virtual and the actual produces complex results, consisting of simultaneous representation of the material world (physical, real-world or its representation in the mode of everyday visibility) as well as the virtual elements which exemplify the abstract code i.e. the idea.

The augmented reality (AR) system was the most natural choice for the project since it includes elements of the real world and digital data (virtual world) at the same time, and is interactive in real time, which is giving chance to make the process of detaching color from form aboveboard.

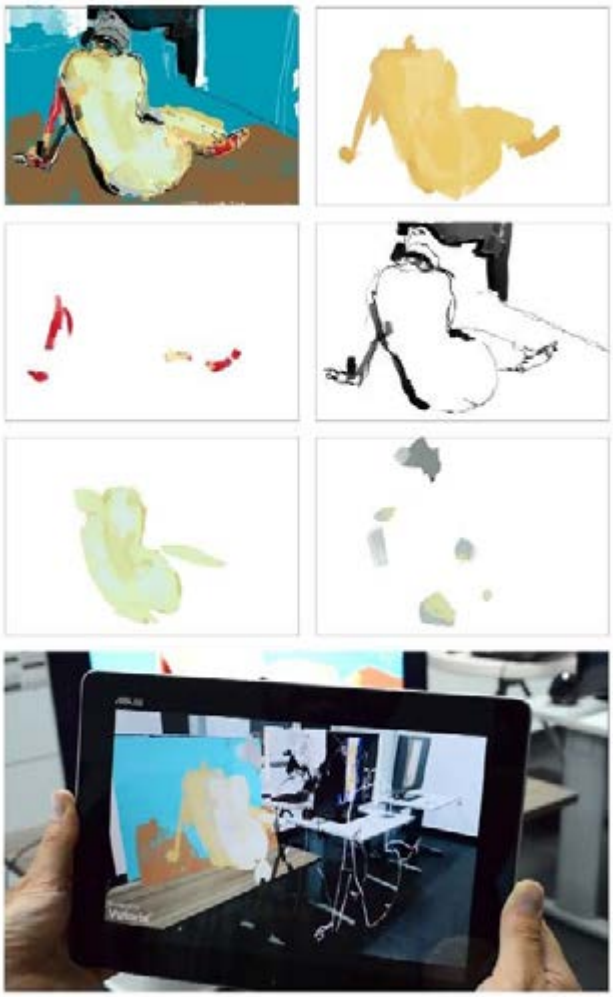

Figure 2: Some of the painting layers (holding individually a number of color patches, brushstrokes etc.) and the abstract AR image, 2016. After detecting the marker and deducing the location and orientation for virtual overlay, the system augments each of these layers, hence detaches and offsets multitude of abstract color shapes into various combinations, creating complex permutations.

The augmented reality system used in the art installation is *simple*, designed to create immersive environment simulated by computer. Consisting of a camera, computational unit and a display, the system is run on a tablet PC using a built-in camera. By using *marker-based* tracking, it captures the *marker*, which is digital painted nude depicted in a mode of everyday visibility, displayed on a large TV screen.

In fact I begin with digital painting, nude painted on many layers (by using Adobe Photoshop software application) where each layer holds individually a number of color patches, brushstrokes and so on. Joseph Nechvatal explains digitization as a key metaphor for viractuality in the sense that it is the elementary translating procedure today. But the viractual recognizes and uses the power of digitization while being culturally aware of the glamourous values of monumentality and permanency qualities that can be found in some previous compelling analog art that grounded itself in the spiritual value of beauty.

The AR applications are created in Unity software application, as well as the virtual components of the installation. The augmentation is in 3D, consisting of multiple parallel offset planes (and parallel to the marker), holding the Photoshop layers i.e. different abstract color patches, color patterns, brushstrokes etc. produced during the nude painting process.

After detecting the marker and deducing the location and orientation for virtual overlay, the system augments each of these layers, hence detaches and offsets multitude of *abstract color shapes* into various combinations, creating complex permutations. The actual whole is translated into abstract AR image, allusive or completely non-objective, and the audience is directly involved in the process by activating the augmented reality.

Image as a Secondary Manifestation of the Primary Vehicle of Creativity – the Abstract Code

The hallmark of modernism of XX century is the new way of perception of the visual world, art that is conceptually structured, more subservient to the idea and meaning, rather than visual aesthetic (Abandonment of a single point of view and normal proportions i.e. highly stylized figures and space). In a broad sense it is not accidental that the rise of

[3] Viractualism is an art theory term developed by Joseph Nechvatal in 1999. The basis of the viractual conception is that virtual producing computer technology has become a noteworthy means for making and understanding contemporary art and that this brings artists to a place where one finds the emerging of the computed (the virtual) with the uncomputed corporeal (the actual).

modern art coincides with the discovery of "old art" everywhere in the world: Arts of Africa, the ancient cultures of Maya and Aztec, medieval art of Byzantium, etc. The avant-garde artist, in their effort to make a big revolution in art in the first decades of XX century, i.e. to break out from the representational art, were looking for a radical change of *space* and *form* in painting. The "old art" possesses all of this things, because it is conceptually structured, more subservient to the idea and meaning, rather than visual aesthetic. Furthermore, it is open to the possibilities for paraphrase and contemporary interpretation.[4] One of the main divisions in abstract art is the *nongeometric abstract art*, or so-called *natural abstraction*.

Claude Monet made revolutionary discovery in his late artworks by reaching a new advancement in painting and revealing the *independent meaning of the color*, which is one step close to the abstract art (Dimitrov, 2001). Unlike the widely accepted painting techniques by the Parisian Art Academy which were going in favor of preciseness and detail, *Impressionism* came to be mostly opposite of that. Instead of painting in closed space and detailing the painting, it revolved around the 'impression', which was mainly inspired by light. As the author of the referenced book on Impressionism, Camille Mauclair, states in his book "The French Impressionists (1860 – 1900)", impressionists believe that there is no such difference between the *form* and *color*. "In nature the distinction does not exist. Light reveals the forms, and, playing upon the different states of matter, the substance of leaves, the grain of stones, the fluidity of air in deep layers, gives them dissimilar coloring. We only see colors; Everything has a color, and it is by the perception of the different color surfaces striking our eyes, which we conceive the forms" (Mauclair 2004, chap. 2, para. 2).

Furthermore, the impressionists believed that there is no such thing as color in nature as well. The only source of color as such is sunlight, and its reflection upon all objects gives them their color, which changes infinitely as the hours pass. There is no color peculiar to any object, but only more or less rapid vibration of light upon its surface. The speed depends, as is demonstrated by optics, on the degree of the inclination of the rays which, according to their vertical or oblique direction, give different light and color. Shadow is not a part of the landscape, only the colors in the shadow are modified by refraction i.e. shadow is not absence of light, but light of a different quality and of different value.

For the impressionists the moment was very important. Objects in nature look wonderful under light that is changing very fast, and that was the impression they were trying to capture. Donald Kuspit explains these impressions as sensations, and the idea about the objects as sum of these sensations. He explains that impressionists seemed eager to detach the sensations from the representation. Nevertheless, we can talk about complete separation of sensations from representation with the development of non-objective art and the concept of non-objective sensation. Kandinsky is formulating his concept of non-representational art as one originating "in some inner necessity of the artist to find a spiritual art form free from all references to the external world" (Honour & Fleming 2010, p. 780). Abstract formal qualities when express the artist's innermost feelings create a true spiritual reality.

This historical transition from representational to abstract painting i.e. separation of sensation from representation, acquires new aspects when translated through the digital media and AR (Augmented Reality) computer technology, and involvement of the audience in the process.

The interaction between the virtual objects and the real world brings new aspects to the concept about the image as a secondary manifestation of the primary vehicle of creativity – the abstract code. By using the AR technology, the final result is giving chance to observe simultaneously the material world (physical, real-world or its representation in the mode of everyday visibility) as well as the virtual elements which exemplify the abstract code. The view of the reality is altered or at some points completely replaced by a computer. The work is complete only when the audience see both nudes simultaneously, while tracing their similarities and differences.

The material nude is "marker" that activates the AR, thus revealing the sensations and the heavenly nude. The sensations that once were the material nude has been given abstract permutations in a process that continues without pause. Here I would like to mention Prof. Donald Kuspit once again, in particular his explanation about Michael Somoroff's computer generated digital video Query (2004). He is talking about two nudes as a mirror images – more particularly, translations – of each other. The idea could be equally applied in this project. Nothing is distorted or lost in the translation between the nude depicted in the mode of everyday visibility, and the AR abstract image. The realistic image and the abstract image are exact equivalents. The

[4] In Macedonian modern and contemporary art we can say that art tradition is of a great importance. Just through tradition, Macedonian authors find their "modernity" and above all their creative identity. Different cultural and historical conditions mean different understanding of innovation and tradition i.e. in different periods of time in a different way the tradition is incorporated into the modern creations. But as a general feature is the fact that the artistic tradition is a basis for creation of modern artistic vision. Here I am talking about philosophical understanding of this art paradigm, established level of communication that is overpassing the standard patterns of recognition.

latter codifies the former even as the former exemplifies the latter, that is, embodies the code. He also suggests that the "heavenly nude" is more beautiful and perfect than the "earthly nude", because the "heavenly nude" is temporally paradigmatic, all-but-invisible abstract nude viewed in an intellectual epiphany – the altered consciousness of a visionary (Kuspit, 2005).

Conclusion

This paper looked at a concrete creative process of the art installation titled "Augmented Abstraction". Subject of this paper as well as of the installation is the *inter-spatiality in art*, the new understanding of human presence, inhabiting both the real (uncomputed, corporeal, actual) and virtual (computed) worlds at the same time. The objective of the installation is to investigate and point out some of the new aspects to the concept about image as a secondary manifestation of the primary vehicle of creativity – the abstract code, emerging from the interaction between the virtual objects and the real world.

In the course of the discussion it is suggested that the *Augmented Reality (AR)* as part of the *Mixed Reality (MR)* is bringing us in front of a new radical change of our optical perception and consciousness – concept that is getting beyond our perceptual capabilities. The interaction between the virtual objects and the real world is giving chance to observe simultaneously the material world (physical, realworld or its representation in the mode of everyday visibility) as well as the virtual elements which exemplify the abstract code. The work is complete only when the audience see both nudes simultaneously, while tracing their similarities and differences. The material nude is "marker" that activates the AR, thus revealing the sensations and the "heavenly nude". The sensations that once were the material nude has been given abstract permutations in a process that continues without pause.

References

Ascott, R. (1994). *The Architecture of cyberception*. Retrieved from https://w2.eff.org/Net_culture/Cyborg_anthropology/cyberceptionpaper.

Kuspit, D. (2005). *The matrix of sensation*. Retrieved from http://www.artnet.com/magazineus/features/kuspit/kuspit8-505.asp.

Florensky, P. (2002). Reverse perspective. In N. Misler (Ed.), *Beyond vision: Essays on the perception of art*. (p. 202). London: Reaction Books LTD.

Antonova, C. (2012, February). Visuality among Cubism, Iconography, and Theosophy: Pavel Florensky's Theory of iconic space. *Museum of Russian Icons*, 10.

Antonova, C. (2012, February). Visuality among Cubism, Iconography, and Theosophy: Pavel Florensky's Theory of iconic space. *Museum of Russian Icons*, 3.

Honour, H., & Fleming, J. (2010). *The visual arts: A history* (revised 7th ed.). New Jersey: Pearson.

Honour, H., & Fleming, J. (2010). *The visual arts: A history* (revised 7th ed.). New Jersey: Pearson.

Nechvatal, J. (2009). *Immersive ideals/critical distances: A study of the affinity between artistic ideologies based in virtual reality and previous immersive idioms*. (Doctoral dissertation). University of Wales College, Newport, Wales, U. K. Siltanen, S. (2012). *Theory and applications of marker-based augmented reality*. Finland: VTT Technical Research Centre of Finland.

Nechvatal, J. (2001). Towards an immersive intelligence. *Leonardo, 34, 5,* 417-22.

Dimitrov, D. (2001). *The art of 20th century – the destiny of the avant-garde*. Sofia: Prosveta.

Mauclair, C. 2004. The French Impressionists (1860 – 1900). Retrieved from: http://www.gutenberg.org/files/14056/14056h/14056-h.htm.

Honour, H., & Fleming, J. (2010). *The visual arts: A history* (revised 7th ed.). New Jersey: Pearson.

Kuspit, D. (2005). *The matrix of sensation*. Retrieved from http://www.artnet.com/magazineus/features/kuspit/kuspit8-505.asp.

Collaborative Composition with Creative Systems

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Abstract

Computational assistants are now regularly used in creative industries, and their use in music dates back practically to the 1950s, and theoretically to the 19th century. The author describes specific instances of interactive and algorithmic music systems from the last 50 years as examples of artistic assistants, suggesting that such systems exhibit only a limited role in the creative process. True collaboration, as evidenced in traditional human practices, requires greater autonomy, independence, and potential influence; he describes his collaboration with his most recent metacreative system, *Moments.*

Keywords

Collaboration, composition, creativity, metacreation, generative music.

Introduction

The possibility of having a virtual creative assistant has intrigued artists since the mid-nineteen century, when Ada Lovelace speculated upon the musical potential of Babbage's Analytical Engine [Toole, 1996]. There are many instances of computers being used as creative assistants, helping to fulfill the vision of [usually) a single artist; within music, an entire branch of computer music has been dedicated to interactivity in performance [Garnett, 2001]. However, I argue that while a creative assistant is certainly useful, such a role is always secondary to a principal artist; collaboration with a software system, in which both contribute equally to the final artwork, is now becoming a possibility through the use of new techniques borrowed from artificial intelligence.

This paper will describe how my use of my own software has evolved from assistant to collaborator, focusing upon a recent metacreative system, *Moments*.

The State of the Art in the 1980s

I have been creating software systems to aid in my musical composition for over thirty years. In the mid-1980s, when I was still a graduate student, a new paradigm was emerging: creative artists, with a mixture of interest and effort, could learn to code, and use new affordable home computers to help in their creative process. Within my area of musical composition, the Atari ST and the Apple Macintosh computers could be programmed to control relatively inexpensive commercial synthesizers, such as the Yamaha DX-7, using a newly standardized method of communication, the Musical Instrument Digital Interface, or MIDI. Such personal systems, while clearly idiosyncratic and ad-hoc, allowed for a more mercurial approach lacking in electroacoustic music at the time. MIDI was originally intended as a performance interface, allowing musicians to couple and control inexpensive digital synthesizers; but by putting a MIDI port on the back of the affordable Atari ST computer, new possibilities for compositional control were afforded [Dorfman and Young, 1986].

One can wistfully look back at this period, where creative coders were unbound by commercial aesthetics and molds, completely free to explore their individual artistic directions. The (now) ubiquitous music sequencer, itself replicating the older model of the tape studio (e.g. Logic's, Pro Tools', and Cubase's transport and multi-track format) was yet to be released. That said, since there were no actual music programming languages, artists were forced to not only learn, but also often bend, existing programming environments to meet their unique requirements.

One paradigm, of which George Lewis' *Voyager* system is the best example, was that of an improvising ensemble which interacted with a live instrumental performer through rudimentary machine listening [Lewis, 1999]. The problem of understanding what the performer was doing was partially solved for us, in that a commercial pitch detection system that converted live monophonic audio to MIDI events – the *IVL Pitchrider* – was available. Using the *Pitchrider*, it was possible to track a live performer, and determine the relative range she was playing (i.e. low versus high notes), how active she was (i.e. how many new MIDI events were being generated every second), how loud she was playing, and whether she was playing rhythmically or not (extracting tempo and rhythmic patterns was quite a bit more complicated), and, perhaps most useful, whether she was even playing.

These systems were viewed as creative partners, real-time systems with which artists could interact in performance that could produce output that designers might not have directly dictated, but, ideally, *could have*. The surprise that designers hoped to discover

while interacting with their software was engendered through constrained random procedures [Winkler, 2001], allowing the computer to select from a predetermined set of possibilities: for example, playing pitches from a given set, or outputting note events at a specific tempo, selecting from a weighted set of rhythmic subdivisions. I doubt if anyone considered their software truly "creative" or "intelligent": we were happy if the system produced novel and somewhat unexpected output. Chadabe suggested that "indeterminacy is the heartbeat of the interactive system" [Chadabe, 1996], while I have suggested that indeterminacy is a poor substitute for intelligent musical decision-making [Eigenfeldt, 2007].

Cope and Early Generative Ideals

We can look back now and determine that the cutting-edge artificial intelligence research in music in the 1980s was following the general AI trend of the time in attempting to create expert systems: in the case of music, software that could voice Bach chorales properly [Ebcioğlu, 1988]. It was at this time that David Cope began to create his Experiments in Musical Intelligence (EMI, or Emmy), a creative system whose goal was initially to produce new music, but quickly veered into reproducing existing musical styles [Cope, 1987]. Cope produced a wonderful compendium of publications tracing his technical and aesthetic development over the course of creating Emmy, culminating in his description of his decision to essentially kill Emmy by destroying her database in 2003 [Cope, 2005].

Since Emmy used machine learning to generate her own rules, Cope's interaction went beyond only coding her; by deciding the compositions from which Emmy should learn – i.e. by curating the database, or corpus – Cope was making selective decisions that contributed to the resulting music. Furthermore, Cope's work-flow had Emmy generate dozens, if not hundreds, of generations, from which he would select what he subjectively felt was the best version. As an artist, he felt he had the right to make such selections without explaining these decisions beyond simple intuition or aesthetic preference; unfortunately, the scientific community considered such decisions "cherry-picking". Cope always claimed that "what matters most is the music" [Cope, 2005], which simply doesn't fly with scientists, who countered "with hand-coded rules of whatever kind, we can never get away from the claim that the creativity is coming from the programmer and not the program" [Wiggins, 2008]. Clearly what Wiggins objected to was not the fact that a system could generate music – Wiggins is a leader in the field of computational creativity – but that Cope suggested that Emmy was "creative" on her own. The computational creativity community believes that the final selection must be made by the system itself, and the only way a system can do that is if it understands what it is doing, and can judge its output based upon its own clear goals [Ventura, 2015]. Unfortunately, successful computational aesthetics are still a ways off [Galanter, 2012]; in the meantime, artists are still required to have some influence upon making the final selection.

Sidestepping the argument of pure machine creativity, more interesting is Cope's subsequent creation of Emmy's "daughter", Emily Howell. Whereas Emmy reproduced music within a clear style by learning the style's rules from a corpus, Emily Howell produces new music through association, involving a conversation between Cope and the system: a novel, but certainly ad hoc, method [Cope, 2013]. Since Cope no longer claims Emily Howell as being creative on her own, he has been left to his own musical devices by the scientific folks.

Generative Music & Metacreation

An alternate approach to generating music in real-time was using computers to algorithmically create traditional musical notation for later performance by acoustic instruments. Using computational means to produce fixed music had existed for several decades; indeed, the first use of a computer in music was Hiller's *Illiac Suite* of 1958, in which algorithms were created to produce number streams, which in turn were hand transcribed into musical notation and played by a string quartet [Hiller, 1964]. Other examples include Xenakis programming stochastic methods [Xenakis, 1971], and Koenig's Project II, which generated serial music [Koenig, 1978]. Barlow used the computer as a compositional assistant to produce acoustic music beginning in the 1970s [Barlow, 2010]. Many other examples exist, demonstrating what composers in the field considered algorithmic music: simply put, music produced by algorithms.

In 1996, Eno came up with the term Generative Music, which codified a practice implicit in algorithmic systems, but not explicitly stated: the notion that a system could produce multiple iterations of a work, and each would be considered viable and representative of the work itself [Eno, 1996]. Realtime interactive systems (e.g. Lewis' Voyager) produced a single instance – that heard in concert – but were capable of producing multiple alternative versions; non real-time systems could produce multiple outputs (e.g. Cope's Emmy), but composer-designers selected one version that they deemed to be the best. Koenig went so far as to state that it was inherent upon the designer to not alter the output in any way, but only alter the

underlying algorithm which produced the output [Koenig, 1983]. His goal reflected the modernist aesthetic of searching for the perfect fixed object; Eno's embodied the postmodernist acceptance of continual change.

Galanter points out that generative art, and by extension generative music, does not require computational means, offering a more inclusive definition that posits the use of autonomous systems and processes creating or contributing to the creation of an artwork [2003]. Processes have a long history in music – from the rules to generate a 14th century musical canon to 20th century serialism, for example – and haven't required software for their execution. However, recent applications of artificial intelligence, evolutionary algorithms, and cognitive science have created a contemporary approach to generative art, known as metacreation [Whitelaw, 2004]. Musical metacreation (MuMe) looks at all aspects of the creative process and their potential for systematic exploration through software [Pasquier et al., 2016].

Musebots

The MuMe community has produced a variety of creative systems with rich musical results. However, the complexity of individual projects has resulted in idiosyncratic, non-idiomatic systems, created by artist-programmers with ad hoc means. A push was made to create a shared platform for MuMe interaction that would allow multiple practitioners to communally develop individual musical agents, or musebots [Bown, et al. 2015]. Within a year of developing the musebot protocol, over five-dozen individual musebot contributions existed. These were presented in continuous running installations [Eigenfeldt, 2016], curated into ensembles of 3–7 musebots. As the musebots generated music in a variety of styles, curation was a creative activity in itself; it was found that combining diverse styles rarely produced satisfying music, while combining similar styles produced music that was surprising and musically successful (as evidenced by their successive acceptances at international festivals).

As the main musebot developer, I found myself imagining ensembles in advance, envisaging how individual musebots might interact, and coding new musebots with that goal in mind. Because musebots themselves are self-contained, and react to other musebots, conceiving of a final musical result was a process in itself: one cannot control the exact output of a musebot, only how it interprets, and reacts to, its environment. While I recognized the musical limits of the musebot ensemble [see Eigenfeldt, 2017], such creative collaboration with (moderately) intelligent systems stoked my interest in pursuing actual collaboration with more powerful musebots.

Interaction versus Collaboration

As mentioned, early practitioners of real-time systems aimed for interactivity. Chadabe [1984] describes in detail his approach, which he refers to as *design-then-do*; he would create a system with which he would later interact in performance. What becomes clear in this paradigm is that the interaction is instantaneous: his actions cause an immediate reaction in the system, which then generates musical material that is heard, and can be reacted to, which in turn causes a further reaction by the system. Such direct relationships are the basis of the longstanding notion of human-computer interaction [Card et al., 1984], which continues to be an active field of research inclusive of artistic media [1]. While the potential for artistic partnership between human and computer may nominally exist within such systems, I would argue that it is a relationship much different than a collaborative one.

In viewing human interaction in creative performance, performers may interact with one another to alter a performance as it is occurring: for example, a string quartet executing a collective slowing down in tempo, or contact dancers devising movements on the spot. However, this is fundamentally different than artists collaborating on a creation, which tends to occur *before* a performance in the design process. Collaborators influence one another's artistic planning rather than only its execution.

Within music, computer-assisted composition offers the human composer assistance in executing their artistic notions. Assayag et al. describe some powerful tools designed to offer the user suggestions, particularly on the more difficult concepts regarding structure [2006]. Such research can be considered a branch of computer-assisted creativity, which often goes as far as modeling cognitive processes in order to aid creativity [López-Ortega, 2013]. However, both examples remain creative assistants, which are fundamentally different than collaborators; the former helps a single creator achieve something new, while the latter shapes that vision by offering alternatives as well as supporting views.

I propose that collaboration *can* occur between artists and systems, but in order to attain an equality between the two – necessary for the latter to become more than assistant – the system must potentially alter the artist's vision with suggestions that are unexpected, and that these proposals occur prior to the generation

[1] See, for example, http://www.nime.org/

so as to affect structural, not just surface, aspects. Lastly, I propose that this can only be done if the system exhibits some form of creative intelligence, combined with a developed trust between the artist and the creative software.

Collaboration with Intelligent Systems

In 2016, I began to use musebots in a closed system, each one developed by myself for a specific purpose within a specific generative work, *Moments*. Rather than employing a bottom-up, self-organising, improvisation model of the musebot ensemble, *Moments* is a combination of top-down and bottom-up methodologies. A `ParamBOT` generates a structure for each ten-minute composition, consisting of individual sections within which audio musebots negotiate the musical details, given the goals provided by the `ParamBOT`. A section, or moment, is comprised of a static entity – for example, a single harmony; moments avoid development and goal-directed behaviour, although the potential for processes to provide variation in the surface design are possible. Subsequent moments are contrasting, often dramatically, with one another, as their internal organisation and concerns must be different; as a result, changes between moments result in what Kramer refers to as discontinuity [1988].

One initial goal of *Moments* was the generation of complete musical structures, a complex issue not fully solved in generative music [Eigenfeldt et al., 2016]. *Moments* creates such structures without any human interaction, and continually composes, then performs, ten-minute compositions.

A great deal of my time has been spent fine-tuning the ensembles for *Moments*. As before, ensembles are specific collections of musebots active in each composition; in the case of *Moments*, the musebots are all my own, and currently number seven unique audio generating types. Ensemble scripts also dictate (to a degree) how individual musebots should behave through setting personality parameters, such as impatience, persistence, vitality, consistency, and compliance. The act of specifying an ensemble is a creative act in itself, a curation of potential actions without dictating specifics.

Because *Moments* is completely autonomous, and no interactivity is possible, it is outside the improvisational model of Chadabe's interactive composition. Like most generative systems, *Moments* is software created through an iterative design process: continual testing of the system results in fine-tuning of its code and/or parameters: what Oliver Bown describes as "finding the sweet spot"[2]. One could therefore argue that coding such a system is in an act of collaboration, as the output of any metacreative system will always (or at least hopefully) be surprising, and perhaps suggest new directions to its coding and revision. However, the collaboration is only in one direction: while the design and test methodology may result in alterations to the code due to successive listening, the resulting changes to the code are permanent, thus ending that specific avenue of collaboration.

I have found that my own relationship with *Moments* is different than with any other generative system that I have created [see, for example, Eigenfeldt, 2009]. Because it lacks interactivity, I am required to listen to the complete compositions that it produces; rather than immediately altering surface features as I hear them, I listen to its overall evolution, and react to its musical structure, perhaps similar to how a director might take notes of a complete run of a show, rather than stopping to fix problems in individual scenes. Like human improvisers, musebots are independent and autonomous; I can suggest and possibly provoke, but, unlike chamber musicians reading fixed scores, I cannot force them to perform specific actions.

Moments is a complex system. Like any such system, it is difficult to understand the complex interactions that occur while it is operating, even as its designer. As already mentioned, parametric adjustments – such as raising an individual musebot's volume at a certain point – are not possible, since that parameter was calculated for that instant due to many underlying factors. Instead of interacting with the system directly to adjust the volume, it is necessary to understand *why* the musebot may be playing at a low volume: does it's personality have too low a vitality attribute so as not to be able to sustain longer periods of higher volume? A higher vitality attribute may solve this, but it will also influence how the musebot behaves in other sections. Was the overall request structural request for low volume being met by this agent, thus demonstrating a high compliance, while other agents were non-compliant and playing louder than requested? Matching all musebot compliance levels more closely may result in a more uniform volume level, but it will also disrupt the overall variety between them. This type of collaboration between musebots and myself has led to not only refining specific ensembles, but also suggesting new ones.

Similarly, extended listening has suggested alternative versions of *Moments* that create distinctly

[2] Personal communication

different artworks[3]; *Moments: Polychromatic* uses a variety of audio producing methods that highlight their timbral differences; *Moments: Monochromatic* uses a single synthesis technique that emphasizes timbral similarity opposed to a live performer's input. In each case, I have created related musebots – cousins, if you will – that are placed in completely new environments in an effort to discover new relationships between them, as well as new relationships between them and myself.

Perhaps most surprisingly to me is that *Moments* is attempting to defy its own purpose: each composition and performance was meant to be considered a unique entity that exists only once in a mercurial form, a musical quantum that cannot be revisited. But due to the sophistication of the work that it produces, often generating works of beauty that have gone beyond what I could independently conceive, I feel the need to record its outputs for posterity. My intention may be momentary, but as collaboration, its music deserves to be preserved. The system is clearly complex, and I consider it complete, in the sense that it has been producing successful music presented at international festivals for almost a year. Like many metacreative systems, its output cannot be predicted; however, my relationship with it is not one in which I simply "let it run" on its own; instead, I find that its musical decisions continually provoke me to developing new ensembles, and even new musebots in a way that a theatrical director might decide to switch actors, or a musical director might decide to alter the makeup of her ensemble; in these latter examples, the decisions can only occur when one trusts the other performer/creators to produce something new and unexpected, in the same way that I trust *Moments* to produce a successful composition, even if I add a new musebot into the ensemble.

Conclusion

In recent months, there has been a great deal of media interest in the notion of art created by artificial intelligence[4], with a somewhat predictable reaction and fear of artists being replaced by software. This is reminiscent of any occasion in which new technology has been introduced within society, followed by a propagated fear that the current status quo would be disrupted in a negative way. Artificial intelligence will no doubt change the way artists create, if it hasn't already done so. As described in this paper, many artists in the past decades have already attempted to create a symbiotic relationship with technology; to interact with it is such a way that it assists them in their creative process. Making the tools more powerful by coding autonomous systems that might produce creative ideas on their own will require alternative working methods, but ones that I would suggest are already being used in human creative practice: instead of placing the software in the secondary, and limited role, of assistant, the software can be a viable partner and collaborator, offering independent ideas that extend, provoke, and elevate the individual's creative process.

[3] see https://tinyurl.com/y8r982op

[4] See, for example, a recent BBC news story: https://tinyurl.com/y9hhckm6

References

1. Assayag, G., Rueda, C., Laurson, M., Agon, C., & Delerue, O. (2006). Computer-assisted composition at IRCAM: From PatchWork to OpenMusic. *Computer, 23*(3).
2. Barlow, C. (2010). Mathematics as the Source of Music Composition. *Proceedings of the 1st International Symposium on Music/Sonic Art*, Baden-Baden, Germany.
3. Bown, O., Carey, B., & Eigenfeldt, A. (2015). Manifesto for a Musebot Ensemble: A platform for live interactive performance between multiple autonomous musical agents. *Proceedings of the International Symposium of Electronic Art*, Vancouver.
4. Card, S., Moran, T., & Newell, A. (1984). *The Psychology of Human-Computer Interaction,* Hillsdale, NJ.
5. Chadabe, J. (1984). Interactive Composing: An Overview. *Computer Music Journal 8*(1), 22–27.
6. Chadabe, J. (1996). The history of electronic music as a reflection of structural paradigms. *Leonardo Music Journal*, 41–44.
7. Cope, D. (1987). An expert system for computer-assisted composition. *Computer Music Journal*, *11*(4), 30–46.
8. Cope, D. (2005). Computer models of musical creativity. Cambridge: MIT Press.
9. Cope, D. (2013). The well-programmed clavier: style in computer music composition. *XRDS: Crossroads, The ACM Magazine for Students, 19*(4), 16–20.
10. Dorfman, L., & Young, D. (1986). Atari ST: Introduction to MIDI Programming. Abacus Software.
11. Ebcioğlu, K. (1988). An expert system for harmonizing four-part chorales. *Computer Music Journal*, *12*(3), 43–51.

12. or Computer Improvisation? A composer's search for intelligent tools in interactive computer music. *Proceedings of the Electronic Music Studies Conference,* 2007.

13. Eigenfeldt, A. (2009). The Evolution of Evolutionary Software: Intelligent Rhythm Generation in Kinetic Engine. *EvoWorkshops* Vol. 9, 498–507.

14. Eigenfeldt, A. (2016). Musebots at One Year: A Review. *Proceedings of the Musical Metacreation Workshop*, Paris.

15. Eigenfeldt, A., Bown, O., Brown, A. R., & Gifford, T. (2016). Flexible Generation of Musical Form: Beyond Mere Generation. *Proceedings of the International Conference on Computational Creativity,* Paris.

16. Eigenfeldt, A (2017). Designing Music with Musebots. *Proceedings of the Fifth Conference on Computation, Communication, Aesthetics and X*, Lisbon, 182–192.

17. Eno, B. (1996) "Generative music". Transcript of talk from Imagination Conference, San Francisco, 8 June 1996. In *Motion Magazine*. Available online: http://www.inmotionmagazine.com/eno1.html.

18. Galanter, P. (2003). What is generative art? Complexity theory as a context for art theory. *Proceedings of the 6th Generative Art Conference*.

19. Galanter, P. (2012). Computational aesthetic evaluation: past and future. *Computers and Creativity.* Springer Berlin Heidelberg, 255–293.

20. Garnett, G. (2001). The aesthetics of interactive computer music. *Computer Music Journal*, *25*(1), 21–33.

21. Hiller, L., & Baker, R. (1964). Computer Cantata: A study in compositional method. *Perspectives of New Music*, 62–90.

22. Koenig, G. (1978). Compositional Processes. *UNESCO Computer Music Workshop*, Aarhus, Denmark. Ottawa: UNESCO.

23. Koenig, G. (1983). Aesthetic integration of computer-composed scores. *Computer Music Journal*, *7*(4), 27–32.

24. Kramer, J. (1988). *The time of music: New meanings, new temporalities, new listening strategies*. Schirmer Books.

25. Lewis, G. (1999). Interacting with latter-day musical automata. *Contemporary Music Review*, *18*(3), 99–112.

26. López-Ortega, O. (2013). Computer-assisted creativity: Emulation of cognitive processes on a multi-agent system. *Expert Systems with Applications*, *40*(9), 3459–3470.

27. Pasquier, P., Eigenfeldt, A., Bown, O., & Dubnov, S. (2016). An Introduction to Musical Metacreation. *Computers in Entertainment (CIE) 14*(2).

28. Toole, B. (1996). Ada Byron, Lady Lovelace, an analyst and metaphysician. *IEEE Annals of the History of Computing*, *18*(3), 4–12.

29. Ventura, D. (2015). Mere Generation: Essential Barometer or Dated Concept? *Proceedings of the International Computational Creativity Conference*, Park City.

30. Wiggins, G. (2008). Computer Models of Musical Creativity: A Review of Computer Models of Musical Creativity by David Cope. *Literary and Linguistic Computing 23(*1), 109–116.

31. Xenakis, I. (1971). Formalized Music. Bloomington: Indiana University Press.

32. Winkler, T. (2001). *Composing interactive music: techniques and ideas using Max*. MIT Press.

33. Whitelaw, M. (2004). Metacreation: Art and Artificial Life. MIT Press.

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Empathy in the Ergodic Experience of Computational Aesthetics

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Abstract

Computational artworks develop very particular relationships with their readers. Being able to encode and enact complex and contingent behaviours, a computational artwork exists in a dual state between two layers that are inextricably connected, a computational subface that is often a black box which can only be peeked at through an analogue surface, that mediates but also isolates it. But the procedural layer of the subface can be unearthed through a process of *virtuosic interpretation*, through which readers are able to develop some empathy with the system and arrive at a *theory of the system* that ultimately allows the transferring of some of the artwork's processes to human minds. This paper focuses on how this process is developed and how it is the basis for a unique type of aesthetic experience that leads computational media and art to involve readers in anamorphosis and in a dialectics of aporia and epiphany, that mirrors the superimposition of subface and surface, and from where narrative experiences emerge.

Keywords

Computational Art, Ergodic Media, Artificial Aesthetics, Narrative, Reading, Virtuosic Interpretation, Interaction, Theory of the System.

Introduction: Computational Art and the Ergodic Experience

We may define computational art as art that uses computers, computational systems, or computational media in its creation or deployment. This is a somewhat vague definition, particularly at a time when computational systems are ubiquitous to the point of touching nearly all aspects of our lives and cultures, spawning a bewildering variety of unprecedented forms that challenge the established notions of artistic medium. Vague and encompassing definitions such as this are however well suited for these shifting forms, which have also given rise to a diversity of alternative terms such as e.g. *digital art*, *software art*, *computer art*, *algorithmic art*, *rules-based art*, or *new media art*, among others, to describe either process-based or processor-based artistic practices and forms. Attempts have been made to clarify this apparent terminological disarray, as e.g. in Galanter (2006), Boden and Edmonds (2009), or Lopes (2010), but ultimately, anything close to a terminological agreement seems hard to come by, perhaps even unnecessary.

In light of this, without digressing too much, and not attempting to definitively solve the issue, we nevertheless need to make a brief terminological point so that we are able to focus the discussion. If there seems to be nothing but a slight distinction between designations as *processor-based art* and *process-based art*, we find this to be illusory, as the first of these terms simply brings the medium to the fore, while the latter focus on the nature of the artworks themselves. Similarly, a term such as *digital art* emphasises the codification used in most contemporary computational technologies, while terms such as *computer art* or *software art* emphasise the media, the tools, or the technological infrastructure within which artistic production may be developed. And why is this relevant? Because of the ubiquity of processor-based, digital, computer tools and media upon which much of our culture current develops. Because digital computers and computer networks are pervasive and, acting as a universal solvent for media (Hayles, 2005), have been replacing many of the media technologies in our lives, nearly everything is now mediated by digital computers. Consequently, many art forms inevitably tend to become some kind of digital or computer art, regardless of how much one tries to split the terms and fine-tune definitions.

The capability that computers have to mediate information is quite remarkable. Through the digitisation of media contents and the simulation of media forms, computers and computer networks allowed us to weave an encompassing cultural substrate that surrounds much of our daily activities and is within reach at nearly every moment. However, most of the contents of this *infosphere* are not computational, although they reside in computers (Flichy, 2007; Floridi, 2014). They depend on computation to be archived, transmitted, and enacted, but they ultimately emphasise data and not processes, bringing to mind Chris Crawford's useful notion of *process intensity* (1987), the degree to which a system does the exact opposite, i.e. emphasises processes over data. Process intensity is fundamental in computational media forms and artworks in the same measure as computation is fundamental for their creation or deployment, exactly because it is an expression of computation. Computation in computational art is not merely used for its immediate qualities of speed, economy, versatility, etc., but also because it is understood to be meaningful, and as we will see, additionally becomes one of the aesthetic outputs of artworks, sometimes even their fundamental aesthetic output, their essence and *raison d'être* (Kawano, 1976).

Computation is often a loosely defined term that we may define as any "process that obeys finitely describable rules." (Rucker, 2005, p. 11) The term refers to the abstraction of these processes, not to the actual processes being described, therefore a given "computation is the same regardless of how it is executed." (Lee, 2009, p. 5) This means that although digital computers are often used in computational artworks, the term does not exclude works that do not resort to digital computers, program code, algorithms or effective procedures (Weizenbaum, 1976, p. 46) but that rely instead on computation as a medium to describe structure and process (Mateas, 2005). In this sense, we do not regard this so much as a technological description, but we rather agree with Kevin Kelly's view of considering computation a formal arrangement of matter and energy that may occur in every substance and be communicated between systems that are somehow able to compute (2009). As a result, works that resort to classical media[1] and that are apparently non-computational, may sometimes be found to have a high process intensity, not exactly deploying processes but rather giving human readers[2] the means to deploy processes, with or without the support of the physical infrastructure of the work. We can find examples of this in works as Raymond Queneau's *Cent Mille Milliards de Poèmes* (1961) or Marc Saporta's *Composition Nº 1* (1962), two books that present readers with data and process descriptions and allow them to *execute* the pieces by enacting processes (through the rearranging of verses in the first case and the reordering of pages in the second).

What we then describe as computational art are not only artefacts, accompanied by their inevitable paratexts and subtexts, but rather *abstract machines* that are able to process information but that do not necessarily need to be physically instantiated in the artworks themselves, but may alternatively be instantiated *by* and *in* human readers.

> Computer art runs on computers, so if brains are computers then some computer art runs on brains. This reasoning will give you pause if you reject the assumption that brains are computers; but remember that we've defined computers simply as devices designed to run computational processes, not as silicon circuit boards, and brains are certainly designed to run computational processes. (Lopes, 2010, p. 48)

What we find fundamental is for process and structure of artworks to be computationally defined. This will not only affect the nature and form of the artworks but also the relationships that both authors and readers will be able to develop with them through their media. Espen Aarseth's (1997) definition of *ergodic* is very useful here, as it is able to describe these works in ways that are more focused on these relationships than on their technological infrastructure. The term ergodic is used to describe texts where readers are required to develop a "nontrivial effort" in their reading or, as Aarseth puts it, in their *traversal*, the crossing of the text, which encompasses not only reading as, very often, also its literal construction (Montfort, 2003). During the traversal readers effectuate "a semiotic sequence", that "is a work of physical construction that the various concepts of 'reading' do not account for." (Aarseth, 1997, p. 1) Therefore, ergodic media are characterised by the existence of an ergodic level that may develop concurrently to other levels such as description or narration:

> Narratives have two levels, description and narration. A game such as football has one level, the ergodic. A video game has description (the screen icons) and ergodics (the forced succession of events) but not narration (the game may be narrated in a number of ways, but like football, narration is not part of the game). A hypertext such as *Afternoon* has all three: description ("Her face was a mirror"), narration ("I call Lolly"), and ergodics (the reader's choices). (Aarseth, 1997, p. 95)

If on *Cybertext* Aarseth studies textual forms, it seems clear that we do not need to limit the use of *ergodic* to literature and textual artefacts, and that we may be able to apply it to *all* communicational artefacts, media, or artworks in which similar behaviours may be developed.

Computational Artworks as Black Boxes

At a time when so many cultural and media forms are developed in computational systems, it is almost inevitable that some of them acquire ergodic traits. As a larger number of artefacts are created, developed, distributed, and experienced in computational contexts, we gradually find that classical forms and those forms that are native to computational systems, start sharing traits. There is certainly something of a strong wish to preserve historical models or patterns (such as the novel, the film, the musical album, etc.) but it is hard to counter the effects that the "procedural attractor" has in the digital medium, and the transformations caused that this causes.

We therefore find that in computational contexts contingent and complex behaviours not only become possible, as they are almost inevitable. Empowered by procedurality, the new media forms express the remaining affordances of the digital medium, becoming *participatory*, *spatial* and *encyclopaedic* (Murray, 2012). And *all* the artefacts developed in these contexts become characterised by a *surface* and *subface* duality (Nake, 2016). The surface is the analogue sensorial layer through which signs can be communicated to humans, and the subface is the immaterial and algorithmic substrate of the medium, where computation, code, and processes are developed.

[1] That we could also describe as *analogue*, or *molar* (Lévy, 1997).

[2] We could describe the human counterparts in these cybernetic processes using terms as *users*, *interactors*, or even *players* but we find that none of these terms adequately describes them in all contexts. We have thus preferred to use the more generic term *reader*.

> We do not usually have access to the subface. It is hidden, internal to the computer or the software system. (…) In ordinary terms, we may say that the subface is the algorithm, the description of the class, the program-and-data. In the same manner of describing the situation, the surface is the image on screen, in projection, be it still or dynamic, passive or interactive. (Nake, 2016, p. 16)

The subface is inextricably linked to the mediating surface, but it is also inevitably secluded by it[3] and therefore it becomes a *black box* that readers are only able to explore through its outputs, its surface effusions. If on some black boxes one may not be very interested on the inner workings as on their results or outputs, in computational artworks the mechanics of the black box become something fundamental to grasp.

The Aesthetics of Mechanics

The layer of the *mechanics* of a computational system is defined as its "particular components (…) at the level of data representation and algorithms." (Hunicke, LeBlanc, & Zubek, 2004) The "run-time behavior of the mechanics" is then described as a system's *dynamics*, which in turn will give rise to a layer of *aesthetics*, where one will find the "emotional responses evoked" in readers during the traversal.

Hunicke, LeBlanc and Zubek's MDA framework was developed in the context of game studies, focusing on videogames and particularly on the idea that they are "*more like artifacts* than media", i.e. that their central content is *behaviour*, "not the media that streams (…) towards the player." As such, MDA also becomes relevant to the study of other computational and ergodic forms, precisely because of how it establishes each of the three layers of mechanics, dynamics, and aesthetics as a "view" of the system that stands separate from the others but causally linked to them, both from the designer's as from the readers' points of view.

> From the designer's perspective, the mechanics give rise to dynamic system behavior, which in turn leads to particular aesthetic experiences. From the player's perspective, aesthetics set the tone, which is born out in observable dynamics and eventually, operable mechanics. (Hunicke, LeBlanc, & Zubek, 2004)

The layer of *dynamics* is observable by readers, but that of *mechanics* is not directly perceivable. Regardless of this, mechanics is as relevant to the aesthetic experience as dynamics, but like the subface, it is hidden from view. We should note that the mechanics layer is not the subface, or at least all of it. Our interpretation is that what Nake describes as the subface encompasses not only the mechanics as well as part of the dynamics layer. The surface, on the other hand, starts at the perceivable phenomena in the dynamics layer, and overlaps that of aesthetics, not including however the totality of this, because the aesthetics layer also includes phenomena that lay outside of the artworks, within the readers' minds.

Computational artworks are often open-ended systems that are able to generate seemingly endless outputs and variations. While reading these, if one only follows the systems' surfaces, one may be confronted with traversals that may either be infinite or at least potentially infinite at the human scale. In such cases, regardless of the time and effort put on traversing a system, no single human will be able to fully peruse the entirety of its outputs when facing something like the 10^{14} different sonnets that can be generated from Queneau's *Cent Mille Milliards de Poèmes* (1961), or the 1.8×10^{308} unique icons that are eventually produced by John F. Simon Jr.'s *Every Icon* (1997). As a consequence of this, a *full* and *complete* reading of all the outputs produced by systems such as these is not only often impossible, as it is not even desirable. What then may constitute the focus of the aesthetic experience of these artworks? How is it that readers may be able to experience closure?

Our hypothesis is that the aesthetic enjoyment of computational artworks, and the sense of closure, are linked with an understanding of their subface. The surface remains fundamental, firstly as a focus of aesthetic enjoyment in itself, but predominantly because it is the only gateway available for readers to understand what may be happening at the subface. The relationship between subface and surface is arbitrary (Aarseth, 1997, p. 40), i.e. not constrained in principle by the physical materiality of any particular medium or material, but the subface ontologically precedes the surface, and sets the field of possibilities for everything that may there happen. The surface phenomena can only be "fully understood (…) in light of the internal" level, and from the readers' points of view, whatever is at the subface level "can only be fully experienced by way of the external, expressive level" of the surface (Aarseth, 1997, p. 40).

As readers are unable to exhaust the surface signs, it follows that an understanding of the subface may allow them to anticipate the artworks' formal development, their behaviours and outputs. If systems are interactive, this understanding may also allow them to grasp the "repertoire of possible steps and rhythms" with which they may "improvise a particular dance among the many, many possible dances the author has enabled" (Murray, 1997, p. 153).

Computational artworks are not merely objects but rather *machines*, systems of interdependent processes that evolve autonomously from readers (Boden & Edmonds, 2009, p.

[3] This happens because readers are unable to directly access the subface. We could argue that even in systems such as those described in the following pages, where readers are given direct access to representations of program code, the subface is still mediated by a surface, in this case the representation of the subface as program code that still needs to be interpreted or compiled. The subface is not the program code in itself, but rather those processes that are instantiated in the computational machine, and although these are represented by the program code, they are not *the* program code.

30). It follows that developing some degree of empathy with the artworks, developing *models* or *mental simulations* of their subfaces, a *theory of the system* (ToS), may allow readers to achieve a functional understanding of the artefact, and through this, to attain some closure.

This ToS is not necessarily a full mental simulation of the mechanics, something that in most cases would probably not only not be useful, as would also result in an excessive cognitive burden. It is not a formal description of the artworks' system or of their actual code, but rather an intuitive understanding of their subfaces, a collection of mental models of the system, of heuristics that may help to predict their behaviours. It also does not envision to model all of the computational processes in artworks, but only those that are perceived to be relevant from an aesthetic point of view. Many processes, perhaps even a majority of those that constitute the artworks, are either uninteresting or transparent from this point of view, and as such are not considered in the ToS.

Reading Processes: White Boxes vs. Black Boxes

Gathering some understanding of the subface of a system therefore becomes fundamental in its aesthetic enjoyment. If the artworks' surfaces are the only entry point readers have to their subfaces, reading becomes a more challenging and complex process, as it turns into an exercise of inferring the subfaces from the surfaces. How is this process developed?

We may regard some artworks as being potential *white boxes*, given how they present readers with code or pseudo-code descriptions of the processes. A work as John F. Simon Jr.'s *Every Icon* (1997) describes its process with a simple, straightforward and clear caption:

> **Given:** An icon described by a 32 × 32 grid.
> **Allowed:** Any element of the grid to be colored black or white.
> **Shown:** Every icon.

Other works present actual code, as in Pall Thayer's *Microcodes* series, from which *Sleep* (2009) presents itself as two lines of Perl:

```
#!/usr/bin/perl
sleep((8*60)*60);
```

Finally, other pieces, such as Casey Reas's *Process* series, are accompanied by pseudo-code descriptions of elements and processes such as:

> **Element 1**
> Form 1: Circle
> Behavior 1: Move in a straight line
> Behavior 2: Constrain to surface
> Behavior 3: Change direction while touching another element
> Behavior 4: Move away from an overlapping element
>
> **Process 4**
> A rectangular surface filled with varying sizes of Element 1. Draw a line from the centers of Elements that are touching. Set the value of the shortest possible line to black and the longest to white, with varying grays representing values in between.

But white boxes are somewhat rare. Not only they demand that readers be able to understand the code or the code descriptions, as they may easily become black boxes due to the complexity of the processes presented. Even if one is able to grasp the entirety of the procedural descriptions and is able to mentally imagine its deployment, beyond what seems to be a somewhat low threshold of complexity, the complete computational development will likely be impossible to grasp. If the processes in *Every Icon* or *Sleep* can be easily followed through to their ultimate consequences,[4] those on *Process 4* (2005) are far more complex. Even if readers understand the pseudo-code descriptions, they will almost inevitably have difficulties in predicting the full formal development of its possible outputs. Given some clues regarding e.g. colours or shapes, we may expect some understanding of the field of possibilities to be attained, but this will most certainly not be enough to successfully anticipate the final forms and behaviours of the artworks.

When readers are faced with *black box* systems, if the system is interactive, they may be able to directly peruse the surface and through interaction try to probe the subface, testing the system in order to understand its mechanics. But even direct interaction may not suffice to correctly grasp the subface, and furthermore, not all systems are directly interactive.[5]

The process we described elsewhere as *virtuosic interpretation* (Carvalhais & Cardoso, 2015b, 2017) starts, like every reading process, with the *interpretative function* (Aarseth, 1997, p. 62), through which information starts

[4] Readers are in principle able to follow the processes step by step or to quickly imagine the gamut of all their formal outputs or, to be more precise, to understand the complete field of possibilities within which a system's behaviours will happen and within which the outputs will be generated, and to imagine possible articulations to be developed inside this field, which is to say, consequently, to also imagine all the behaviours and outputs that the system will not be likely or will not be able to produce.

[5] We will follow a stricter definition of interaction than e.g. that proposed by Dominic McIver Lopes (2010), defining interactive systems, or systems that allow for direct interaction, as those that are able to instantiate their code and processes, and to develop bi-directional communication with their readers. Although we sympathise with Lopes's argument of interactive artworks that use "brains to achieve interactivity" (2010, p. 49) we would, in this context, classify these works as non-interactive.

flowing to readers. This interpretative function is omnipresent in all media forms, and often it is the only function accessible to readers (Bogost, 2006, p. 108). What characterises ergodic forms is the presence of further reader functions, such as the *explorative* and the *configurative* (Aarseth, 1997, p. 62; Carvalhais, 2016, p. 244). Through the first of these, readers will be able to decide which paths to follow along the traversal, while through the second they will manage to select or create new surface units in the system.

The balance between functions depends on the dynamics of a system, and on whether direct interaction is allowed. In non-interactive systems, or in contexts of vicarious interaction[6] (Kwastek, 2013, p. 94; Carvalhais & Cardoso, 2015a), the interpretative function will take the lead role, otherwise, any of the other functions may lead, as will often be the case with games or with game-like experiences. But even if the explorative and configurative functions are not directly accessible to readers, the procedural modality (Strickland, 2007; Carvalhais, 2016), our penchant for pattern detection (Eagleman, 2011; Shermer, 2011, p. 5) and for identifying intentional stances and causal relations and affinities (Pinker, 1999), will still allow us to develop them even if indirectly.

As readers interpret surface signs and from them deduce causal relations, they will amass information from these, from mechanics that may be previously known from other systems and that may be remembered and adapted to the current context,[7] and will develop tentative mental models of the system, a conjectural and provisional ToS. This ToS will then be iteratively refined through the confrontation with the actual system, a process that will allow the confirmation, fine-tuning, or falsification of the hypothesis it encapsulates.

This effort is dependent on the possibility to establish multiple contacts with a system, so that the ToS may be effectively evaluated. As computational artworks are performative and time-based systems, multiple contacts are usually required for their thorough reading.

This is a gradual process of creation of meaning. This interpretation of signs, behaviours, and processes is by and large a subconscious process of learning, of building knowledge about the system and of progressively reducing the uncertainty one has about it, of gradually getting to understand its machine through direct contact with its surface or through indirect contact with simulations in the ToS.

Towards Empathy

As a consequence of this process of virtuosic interpretation, artworks become something more than their mechanics, dynamics, and aesthetics layers, being expanded by two concurrent virtual layers that are continuously confronted with them: a layer of *simulated dynamics*, and one of *simulated mechanics*.

Systems also become more than just their surface representations and the particular computational instantiations that readers are confronted with. As readers develop empathy with the systems of the artworks, some of their mechanics are effectively transferred to the readers' minds, where processes can then continue to be developed far beyond the duration of the actual contacts with the artworks. We can regard this dissemination or replication of a work's procedural foci to human minds as one of the goals of computational artworks, perhaps even their quintessential goal.[8]

Furthermore, during the process of virtuosic interpretation, during the trial-and-error stage of developing a ToS, readers are as likely to find models capable of producing good previsions as they are of running into models that do not and that are quickly falsified when confronted with the artworks. Finding that a model is false or incorrect will of course allow for its revision and correction, but it will inevitably also lead readers to experience aporia (Aarseth, 1997, p. 91). Conversely, the confirmation of a model through the verification of its predictions will lead readers to experience epiphany.

The aporia-epiphany dynamic thus generated leads to the development of a unique kind of aesthetic experience, that resorts to cognitive processes that are somewhat rare in other media. Not being in itself a narrative structure, it "constitutes a more fundamental layer of human experience, from which narratives are spun." (Aarseth, 1997, p. 92)

Consequently, computational media become *narrative games* that involve readers in processes of anamorphosis[9] by leading them to assume unconventional stances towards the media of the artworks, ultimately forfeiting the original media altogether, once that the processes are transferred to the readers minds. Computational artworks are therefore not only instantiated multiple times, in their own systems and in readers' minds, as they also spawn variable and divergent instantiations, mutating and becoming individualised in each ToS.

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[6] From the point of view of virtuosic interpretation, we regard vicarious interaction as being very similar in principle to the experience of non-interactive systems, as readers are not able to directly peruse the system but are limited to the observation of the interactions between two systems, one of them a human.

[7] These may include mechanics from physics, and other real-life examples that may be in some way analogous to the system being read.

[8] We could establish a parallel with conceptual art, given that the main goal of both art forms seems to be the transmission of concepts, procedures or instructions (Albert, 2009). Both in conceptual art as in computational art, very often the artist's attention "is focused on exploring systems for their own intrinsic value" (Galanter, 2003, p. 18) but in computational art, code and processes are almost never communicated directly to the reader but are rather mediated by artefacts that embody and instantiate them, that mediate them through computation. Therefore, computational art becomes so because it communicates computation through computation, *expressing* computation.

[9] *Anamorphosis*, as defined by Aarseth consists in hiding "a vital aspect of the artwork from the viewer, an aspect that may be discovered only by the difficult adoption of a nonstandard perspective." (1997, p. 181)

Acknowledgements

This work is financed by the ERDF—European Regional Development Fund through the Operational Programme for Competitiveness and Internationalisation – COMPETE 2020 Programme within project "POCI-01-0145-FEDER-006961", and by National Funds through the FCT – Fundação para a Ciência e a Tecnologia (Portuguese Foundation for Science and Technology) as part of project "UID/EEA/50014/2013".

Cited works

Joyce, Michael. *Afternoon, a Story*. Cambridge, MA: The Eastgate Press, 1990.
Queneau, Raymond. *Cent Mille Milliards de Poèmes*. Paris: Gallimard, 1961.
Reas, C.E.B. *Process 4*. 2005.
Saporta, Marc. *Composition N° 1*. Paris: Éditions du Seuil, 1962.
Simon, John F., Jr. *Every Icon*. 1997.
Thayer, Pall. *Sleep*. 2009.

References

Aarseth, E. J. (1997). *Cybertext: Perspectives on Ergodic Literature*. Baltimore, MD: The Johns Hopkins University Press.
Albert, S. (2009). Artware. In J. B. Slater & P. v. M. Broekman (Eds.), *Proud to Be Flesh: A Mute Magazine Anthology of Cultural Politics After the Net* (pp. 89-92). London: Mute Publishing.
Boden, M. A., & Edmonds, E. A. (2009). What is generative art? *Digital Creativity, 20*(1), 21-46.
Bogost, I. (2006). *Unit Operations: An Approach To Videogame Criticism*. Cambridge, MA: The MIT Press.
Carvalhais, M. (2016). *Artificial Aesthetics: Creative Practices in Computational Art and Design*. Porto: U.Porto Edições.
Carvalhais, M., & Cardoso, P. (2015a). *Beyond Vicarious Interactions: From Theory of Mind to Theories of Systems in Ergodic Artefacts*. Paper presented at the xCoAx 2015, Glasgow. http://2015.xcoax.org/pdf/xcoax2015-Carvalhais.pdf
Carvalhais, M., & Cardoso, P. (2015b). What Then Happens When Interaction is Not Possible: The Virtuosic Interpretation of Ergodic Artefacts. *Journal of Science and Technology of the Arts, 7*(1), 55-62. doi:10.7559/citarj.v7i1.144
Carvalhais, M., & Cardoso, P. (2017). *Creation of Meaning in Processor-based Artefacts*. Paper presented at the ISEA 2017 Bio-Creation and Peace, Manizales.
Crawford, C. (1987). Process Intensity. *Journal of Computer Game Design, 1*(5). Retrieved from http://www.erasmatazz.com/library/the-journal-of-computer/jcgd-volume-1/process-intensity.html
Eagleman, D. M. (2011). *Incognito: The Secret Lives of the Brain*. New York, NY: Pantheon Books.
Flichy, P. (2007). *The Internet Imaginaire* (L. Carey-Libbrecht, Trans.). Cambridge, MA: The MIT Press.
Floridi, L. (2014). *The Fourth Revolution: How the infosphere is reshaping human reality*. Oxford: Oxford University Press.
Galanter, P. (2003). *What is Generative Art? Complexity theory as a context for art theory.* Paper presented at the Generative Art, Milan. http://www.philipgalanter.com/downloads/ga2003_what_is_genart.pdf
Galanter, P. (2006). Generative Art and Rules-Based Art. *Vague Terrain*. Retrieved from http://philipgalanter.com/downloads/vague_terrain_2006.pdf
Hayles, N. K. (2005). *My Mother Was a Computer: Digital Subjects and Literary Texts*. Chicago, IL: The University of Chicago Press.
Hunicke, R., LeBlanc, M., & Zubek, R. (2004). *MDA: A formal approach to game design and game research*. Paper presented at the Challenges in Games AI Workshop, Nineteenth National Conference of Artificial Intelligence, San Jose, CA.
Kawano, H. (1976). What is Computer Art? In R. Leavitt (Ed.), *Artist and Computer*. Morristown, NJ: Creative Computing Press.
Kelly, K. (2009). Infinite In Some Directions. Retrieved from http://www.kk.org/thetechnium/archives/2009/05/infinite_in_som.php
Lee, E. A. (2009). Computing Needs Time. Retrieved from http://www.eecs.berkeley.edu/Pubs/TechRpts/2009/EECS-2009-30.html
Lévy, P. (1997). *Collective Intelligence: Mankind's Emerging World in Cyberspace* (R. Bononno, Trans.). Cambridge, MA: Perseus Books.
Lopes, D. M. (2010). *A Philosophy of Computer Art*. Oxon: Routledge.
Mateas, M. (2005). Procedural Literacy: Educating the New Media Practicioner. *On The Horizon. Special Issue: Future of Games, Simulations and Interactive Media in Learning Contexts, 13*(1).
Montfort, N. (2003). *Twisty Little Passages: An Approach to Interactive Fiction*. Cambridge, MA: The MIT Press.
Murray, J. H. (1997). *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*. Cambridge, MA: The MIT Press.
Murray, J. H. (2012). *Inventing the Medium: Principles of Interaction Design as a Cultural Practice*. Cambridge, MA: The MIT Press.
Nake, F. (2016). The Disappearing Masterpiece. In M. Verdicchio, A. Clifford, A. Rangel, & M. Carvalhais (Eds.), *xCoAx 2016: Proceedings of the fourth conference on Computation, Communication, Aesthetics, and X.* (pp. 11-26). Bergamo.
Pinker, S. (1999). *How the Mind Works*. London: Penguin Books.
Rucker, R. (2005). *The Lifebox, the Seashell, and the Soul: What Gnarly Computation Taught Me About Ultimate Reality, the Meaning of Life, and How to Be Happy.* New York, NY: Thunder's Mouth Press.
Shermer, M. (2011). *The Believing Brain: From Ghosts and Gods to Politics and Conspiracies — How We Construct Beliefs and Reinforce Them as Truths.* New York, NY: Times Books.

Strickland, S. (2007). Quantum Poetics: Six Thoughts. In E. Kac (Ed.), *Media Poetry: An International Anthology* (pp. 25-44). Bristol: Intellect.

Weizenbaum, J. (1976). *Computer Power and Human Reason: From Judgment to Calculation*. San Francisco, CA: W. H. Freeman and Company.

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Click: an Audiovisual Sound Sculpture

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Abstract

The paper discusses the use of obsolete or out-moded technologies in object-based sound installations. Various approaches and strategies within this context are outlined and a number of significant cross-disciplinary works are surveyed. Developed by the first author, *Click*, an audiovisual sound-sculpture utilising Brownie Box cameras is presented as an example for this creative appropriation.

Keywords

Sound-sculpture, mechatronic art, sound installation, creative appropriation, audiovisual technology, media archeology, brutalism.

Introduction

If the incessant march of technological advancement is victory, this force has been determined in its control and suppression of the defeated – the detritus that is filtered out to "keep the medium distinct from the message." (Auner, 2000).

> If Benjamin said that history had hitherto been written from the standpoint of the victor, and needed to be written from that of the vanquished, we might add that knowledge must indeed present the fatally rectilinear succession of victory and defeat, but should also address itself to those things which were not embraced by this dynamic, which fell by the wayside - what might be called the waste products and blind spots that have escaped the dialectic (Adorno, 1951: 151).

In proposing an emergent post-digital genre of electronic music, Kim Cascone (2000: 1) observes that the "tendrils of digital technology" are a ubiquitous part of the Western world. In this post-digital music, the focus on the sounds of failure – glitches, errors, clipping, distortion, etc. – are incorporated into the music. If the outmoded or the obsolete are considered as failing in the advancement of technology, then another perspective of Cascone's post-digital aesthetic can be considered. This parallel aesthetic arises from the use of obsolete technologies in the creative production of sound art – the antithesis of technological advancement. Both perspectives of this aesthetic can be considered a subversion of technology. The first one can be perceived as subverting the embodiment of the modern with the modern's rejection of old technologies, and its criticism and contempt of the obsolete. Second, by subverting the traditional power dynamics of the victor over the vanquished, Cascone shifts the listeners' focus to the background.

This paper presents how *Click* – an audiovisual sound-sculpture developed by the first author – appropriates obsolete technology (i.e. the vanquished) and repurposes it within a quasi-digital context. The next section discusses contextual and aesthetic elements through which a number of cross-disciplinary works can be connected. A brief survey of artworks sharing similar appoaches towards creative appropriation of media and material is presented. Following this, *Click* is introduced as an example of an audiovisual work in this context. An overview of the design and development of the work is discussed, followed by compositional strategies and aesthetic approaches employed to further strengthen the work's audiovisual connectivity. Lastly, the paper concludes by considering past and present cultural and technological relationships through this creative practice.

Background and Related Works

As consumerism consigns outmoded objects to the technological junkyard, media artists are looking beyond the utilitarian function of these objects, beyond the gaze of nostalgia, seeing ways of creatively appropriating them to produce artworks that use and reference analogue and/or mechanical technologies as an aesthetic and structural element (Huhmato, 1995: 1). In describing the artist Christian Marclay's work in *Cracked Media*, Caleb Kelly (2009: 171) states that rather than utilising the latest technology, Marclay is "using the creaky old device that has been left on the shelf and devising a new aesthetic practice for it", not as a "nostalgic picture of an outdated and obsolete technology", but as a reinterpretation of the technology into something new. Kelly's words echo the writings of Laszlo Moholy-Nagy and Siegfried Zielinski. Moholy-Nagy (1922: 289) stated that "creative activities are useful only if they produce new, so far unknown relationships." Zielinski (2006: 255) wrote;

> Many art and design activists choose to create something original by establishing unusual connections between existing means of expression and/or material; such work stands out significantly from the media products we encounter every day.

Every object has a purpose assigned at creation. However, an object's use can be transformed and placed in different contexts thus establishing new connections and forms of expression. Zielinski (2006: 3) suggests "we need a different perspective" to find something new in the old. One way of doing this is to find new ways of utilising the objects' electromechanical qualities, a practice that is not new in sound-based creative practices.

Just as Cascone wrote that his sounds of failure were often buried beneath perception, the electromechanical object has, at times, shared similar treatment by being pushed into the technological hinterland, in deference to the idealised neutrality of the studio (Piggott, 2017: 278). A number of contemporary sound art practitioners are exploring, manipulating, and foregrounding the use of appropriated and out-moded electromechanical devices for the purpose of creating sound installations and performances. The creative appropriation of everyday objects and the recontextualising of their purpose creates a new cycle of life outside that which was originally intended. Such works typically "engage an audience by actuating a visibly present object", in what Ethan Rose (2013, 65) describes as the object-based sound installation.

In electromechanical sound art, Jon Piggott identifies two distinct approaches; process-driven and robotic. He describes a process-driven sensibility as exhibiting unknown sounding, non-linear and unpredictable material behaviours. He sees the robotic sounding behaviour as being reliable, repeatable and playable with works being composed and organised. In making these distinctions Piggott (2017: 277) notes the difficulty of finding meaningful connections and a common ground across the different genres within which these works exist. However, such a connection has been made with a set of aesthetic principles. Coined by the second author (2016), "sound-based brutalism" is an aesthetic approach encompassing a diverse range of audiovisual works connected through common elements: a radically stripped down focus on basic sound-generating mechanisms and material, and their presentation through grid-based structures and repetition. In addition, exposure of the raw materials provides a visual emphasis on the sound producing source. No longer hidden in the background or listened to as sound "divorced from the context of visual meanings", works by such artists as Zimoun, Martin Messier and Stephen Cornford are foregrounding the sound producing object reduced to its raw material form as a key aesthetic element of their work (Rose, 2013: 66). Alongside this exposure of the basic physical unit is its iterative presentation as a building block for the resultant audiovisual output. Using brutalism as an aesthetic frame of reference is in part an effort to establish a meaningful connection and find common ground across genres that Piggott found difficult to make.

An explicit realisation of this aesthetic approach is *The Brutalist Noise Ensemble* (Figure 1), a series of sound scupltures developed by the second author (2015). The reductionist, raw, and minimalist features of the sculptures, as well as the harsh, monotonous, repetitive clicks, clacks and whirs of the motors and actuators are reminiscent of Brutalist architecture's non-decorative and "anti-beauty" approach towards raw material (Zareei, 2016: 57-58).

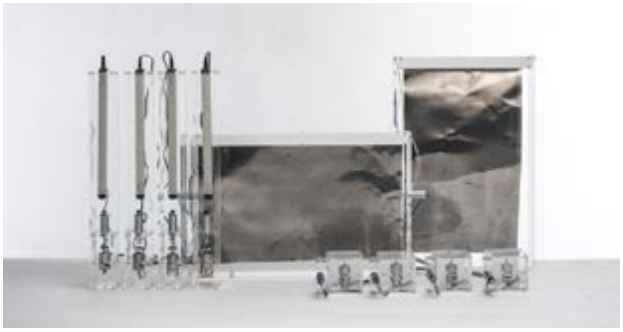

Figure 1. Mo Zareei's Brutalist Noise Ensemble © Mo H. Zareei

Exemplars of object-based sound installations using out-moded technologies include installations by Martin Messier. *Sewing Machine Orchestra* (Figure 2) is a striking audiovisual work utilising Singer sewing machines (Messier, 2011).

Figure 2. Martin Messier's Sewing Machine Orchestra © M. Messier

As an installation piece, the work gives the impression of new life occuring in old technology as the light and early sounds seem like a quickening heartbeat. Similarly, Messier's appropriation of 8mm projectors in *Projectors* allows him to use the rhythmic sounds of their mechanics, whilst presenting them in skeletal form against a stark backdrop (Messier, 2014). The projectors do not project as Messier utilises their sonic artefacts in a coordinated audiovisual performance.

Another example can be found in Nicolas Bernier's *Boite*, which exposes Luigi Russolo's mysterious intonarumoris in response to the black box architecture of today's electronic music (Bernier, 2008). Stephen Cornford's work with dictaphones utilises the sounds of the mechanisms and electrical cracks. *Migration* creates the sound of a flock of birds but as you draw closer to each object the individual sounds are exposed (Cornford, 2015). This spatialisation of each object exposes the differences of each object's sound whilst encouraging the audience to explore these as they move along the work. Cornford's work

reflects on consumer culture, obsolescence and the shorter lifecycles between technological generations.

As previously stated, while not incorporating out-moded technology in their work, a number of media artists incorporate explicit references to old technology as aesthetic and structural elements of their works. Paul de Marinis' *Messenger* (1998/2005) is an Internet driven installation based on the concept of historical electronic communication. The work examines the metaphor encoded within various technology and social relationships through the receipt of emails and sending them "to their demise" letter by letter to various audiovisual outputs. Another example is Dimitri Morozov's (2017) recent project *Ivy* (Figure 3), an interactive sound installation using a 240 step sequencer that acknowledges the archaic method of programming analogue synthesizers through audience interaction of manually changing sliders to control patterns. The large scale of the installation turns a simple sonic element into a series of rhythmic and visual patterns.

Figure 3. Dmitry Morozov's Ivy © D. Morozov

As object-based sound installations, these works share a connection with the first author's work, *Click*. What differentiates these works is Piggott's process or robotic approaches[1]. As a robotic work, *Click* shares a connection with Messier's sewing machines and projectors, Morozov's *Ivy* and Zareei's brutalist sound sculptures. This connection is extended through common elements of Zareei's brutalist sound aesthetic; the use of 'extra-musical' sounds, harsh sonic byproducts or artefacts, generally iterative, pulse-based rhythms and stroboscopic visuals.

Click: Analogue or Digital?

The introduction of the Kodak Brownie Box camera brought photography to the masses and, in the process, democratised the art of photography. With the advent of digital photography, the film camera was consigned to the background. An outmoded memory repository whose digital successors primarily attempt to capture information encoded in 0s and 1s.

Nevertheless, there are some characteristics of this old technology that have been retained in the new technology. In this case, it is the sound of the film camera's shutter, providing a connection between the past and the present. There is also a subjective visual beauty in the rawness of the camera's materials and its simplicity of design and construction, of function over form. This simplicity of function and form made the Brownie camera an interesting source material for *Click* (Figure 4).

Figure 4. Click

Click is the creative appropriation of analogue and mechanical technologies and the reinterpretation of the use of the Brownie camera in the production of sound art. The primary motivation for *Click* is the exploration of sonic artefacts associated with out-moded or obsolete technologies and the creation of a connection with the present. The choice of the Brownie camera was primarily inspired by its modernist technological simplicity that has long been superceded, and not by a sense of nostalgic sentimentalism or retro impulse. The work speaks to the ubiquity of digital technology in current photographic practices represented through one of the early mass consumer products. *Click* uses audiovisual elements to provide a different perspective for representing and experiencing the digital through a juxtaposition with an analogue technology. In a wider context, the work speaks to the increasingly short lifecycle of consumer products in a commodified society. A Moore's Law of obsolescence (Sandborn, 2008).

System Overview

Click is an object-based sound installation that consists of a series of eight Brownie cameras metaphorically representing a digital byte. Each camera has been augmented with a solenoid actuator which operates the shutter. The actions of the solenoids are powered through and programmatically controlled by a microcontroller (an Arduino board) and a driver board. Figure 5 shows the interconnected driver

[1] The term robotic in the context of this work is primarily a reference to Piggott's definition of the word. Through the use of mechatronics and microcontroller programming, the system is capable of robotic behaviour.

boards and circuits. The communication is accomplished via MIDI messages that are generated in Ableton Live.

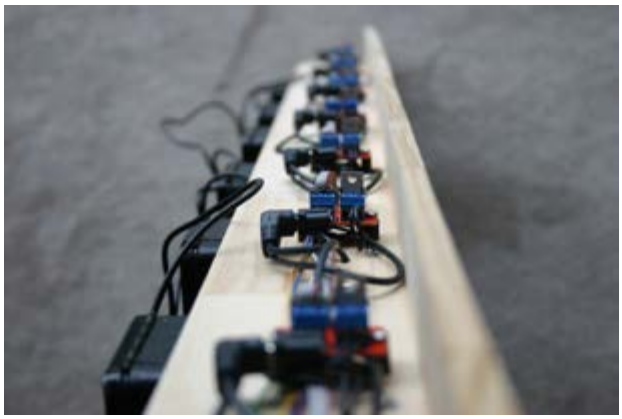

Figure 5. Click Solenoid Electronics

The Arduino uses custom MIDI firmware, HIDUINO[2], to present the microcontroller as a MIDI device to Ableton Live. Ableton Live sends MIDI notes to the Arduino, which translates these as digital pulses that trigger the respective solenoid. A high-level system overview is shown in Figure 6.

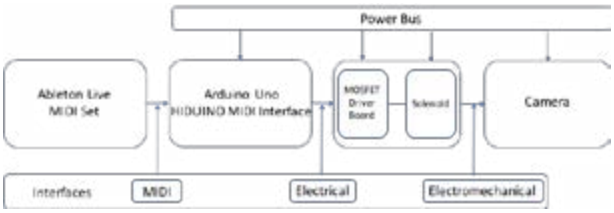

Figure 6. Click System Overview

Click's primary sonic material is provided by each camera's shutter mechanism. A white LED placed in the lens of each camera is exposed when the lens shutter is opened. At the same time as exposing the LED, the sonic artefact of the shutter is heard. By arranging a series of binary-based patterns to a rhythmic grid, sequenced with the visual elements of the LED and the pulsing of the solenoid plunger, the work brings an audio-visual musicality to binary sequences.

Compositional Strategies

At its minimalist prototype state, *Click:Bit* (Figure 7) is a composition for a single camera that can play either a 1-bit loop or a random 1-bit sequence as an installation. The reduction of the work to its basic unit aligns with a minimalist aesthetic that inspired the work. This minimalism acknowledges the digital bit as the smallest unit of data and exposes the nuances of the camera. The physicality of the work can be seen as the camera responds to the body blow from the solenoid. The sonic quality of the object's sound is heard as the shutter resonates in the camera body. *Click*[3] is both a performative and installation work for playing a series of rhythmic grid-based binary compositions.

Figure 7. Click:Bit

This raw building block was then extended to eight cameras, allowing for compositional exploration of audiovisual possibilities within a digital byte of number sequences (Figure 8). An iteration of a single camera unit is an effort to create a richer audiovisual experience, while exposing the characteristic nuances of each camera.

The primary compositional strategy for *Click* is the use of time and space in each composition. Time does not change within a composition as tempo and note length are fixed for the duration. Each composition is set to a fixed grid to accentuate the rhythmic patterns tying together the audio and visual aesthetic elements. Space blurs the boundary between each number by using a fixed musical time for each number. For example, 1 is played as 00000001, with the 0s being rest notes, and plays for the same musical length as 10000001 (decimal value 129). Space is also used to perceptually disrupt the rhythmic pattern and the density of the sound. Rest notes contribute to sound spatialisation as aesthetic elements. This strategy has been used in *Click:Byte*.

Figure 8. Click: Eight Cameras

Click:Byte is composed of number sequences from 00000000 to 11111111 (0-255). Eight bits is a

[2] Diakopoulos, Dimitri. "HIDUINO (2010+)". Retrieved from http://dimitridiakopoulos.com/hiduino.html

[3] A short video of *Click:Byte* can be found at https://youtu.be/66qRHIm9GC0

convenient power of two (2^8) permitting the values 0 through 255 for one byte. As a binary sequence of 0s and 1s (off and on), each bit in the byte can be represented by *Click's* eight cameras. The tempo is fixed at 144bpm and the note length is a semiquaver. Each note is played sequentially; triggered at the trailing edge of the previous note. Playing each note sequentially blurs the distinction between each number and focuses the listener's attention to the rhythmic characteristics of the composition and the space between the sound. Although grid-based, as the patterns step through each sequence the sound density builds and the rhythmic pattern is foregrounded before appearing to be disrupted as the bit sequence shifts left. An extract of the score for *Click:Byte* and the associated MIDI track for each bar shows the rhythmic pattern (Figure 9). A variation of *Click:Byte* changes the pattern sequence and length of each click to explore different rhythmic, temporal and timbral elements.

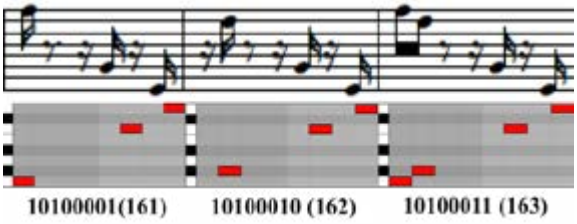

Figure 9. Click:Byte Score and MIDI Extracts

Aesthetic Approach

An important element of Rose's definition of the object-based sound installation is the visually embodied object. No longer invisible and considered an aural by-product, the object is brought to the fore. As a part of engaging an audience, the work should, as Leigh Landy argues, give the audience something to hold on to so to increase accessibilty and appreciation. A strong visual element in relationship to the sound is one of Landy's (2007: 32) access tools for increasing this engagement.

Figure 10. Click:Byte. Close up.

The cameras and solenoids sit atop a wooden platform exposing the mechanical sound making objects that foreground the sound of the cameras (Figure 10). Exposing the objects in this way connects the rhythmic movement of the solenoids and the light from the lens to the conventional rhythm of the sound. As the number count moves left, space is provided between the higher and lower bits highlighting timbral differences in cameras' sounds and creating a quasi-spatialised sound. The timbral differences are then blurred as the sound density increases until the next sequence step.

The camera LEDs are tightly coupled to the rhythm of the click, while the rhythmic movement of the solenoid plungers visually connects with the grid-based rhythm of the composition. The use of a conventional rhythmic pattern as one of *Click's* compositional elements ties these aural and visual elements together. The focus on the sound making objects and their audio and visual rhythmic patterns is enhanced by concealing the electronic components behind a panel that is part of the platform structure. Disrupting this tight audiovisual coupling is the discordant shudder of each camera as the plunger engages the shutter button.

Although the shutter mechanisms of each camera are identical, time and their use has created imperfections in each mechanism. Where the listener may expect to hear the same click from each camera, the erosion of each mechanism and a variation in each camera's resonant cavity adds timbral and spatial variation to the aural aesthetic of the sound sculpture. A perceptible material behaviour disrupts the ideal of a robotic approach to this work.

A button is pressed. Two springs tense. A sliding lever softly reverberates inside the body. Another rasps as it rubs against the body, ending with a metallic bump as it comes to a stop. Like a nictitating membrane, two metal eyelids move in opposite directions. The first exposes the second. The second exposes the eye. Click. The eye shines. Click. The eyelids close.

Conclusions

Moholy-Nagy asked three questions in examining the productive purpose of an object when considering the usefulness of creative activities in producing something new. It is his third question that is addressed here. Are we able to extend the apparatus' use so it can serve production (Moholy-Nagy, 1922: 289)? By appropriating the Brownie camera as a sound making object, its use has been extended and given a new purpose in an object-based sound installation. As an object-based sound installation, the Brownie camera has established a relationship with a number of diverse works that sit, to varying extents, within Zareei's description of a set of shared aesthetic principles. The Brownie camera's form, its sound and the compositional elements that utilise this sound connect with the extra-musical, repetitive, grid-based rhythmic elements and iterative use of the sounding object of a brutalist sound aesthetic. The work also speaks to the historical materialism of objects left behind or 'defeated' in the march of technological progress (Burges, 2013: 66). Presenting the Brownie camera in this new context exposes relationships with other media and its role in the culture of the time. In resurrecting the technological past, a blurring of temporal boundaries occurs between the past and the present, disrupting the linear narrative of progress. Excavating the past in this way, an archaeological dialogue emerges in

finding something new in the old: the relationship between the past and the present and new media cultures through insights from the past, and the relationships from these in creative practice. It is a dialogue to be continued.

References

Adorno, T. (1951). *Minima Moralia. Reflections from Damaged Life*. London: Verso.

Auner, J. (2000). Making Old Machines Speak: Images of Technology in Recent Music. *Echo Volume 2, Issue 2*. Retrieved from www.humnet.ucla.edu/echo.

Bernier, N. (2008). Boite. Retrieved from http://www.nicolasbernier.com/page/works.htm.

Burges, J. (2013). Adorno's Mimeograph: The Uses of Obsolescence in Minima Moralia. *New German Critique 118, Vol. 40, No. 1, Winter 2013*, 65-92

Cascone, K. (2000). The Aesthetics of Failure: "Post-Digital" Tendencies in Contemporary Computer Music. *Computer Music Journal. Vol 24, No. 4,* 12-18.

Cornford, S. (2015). Migration. Retrieved from http://www.scrawn.co.uk/Migration.html.

De Marinis, P. (1998/2005). The Messenger. Retrieved from https://www.youtube.com/watch?v=lJsCloKYAUc.

Huhtamo, E. (1995). Resurrecting the Technological Past. An Introduction to the Archeology of Media Art. *Intercommunication No. 14.*

Kelly, C. (2009). *Cracked Media: The Sound of Malfunction.* Cambridge, MA: MIT Press.

Landy, L. (2007). *Understanding the Art of Sound Organisation.* Cambridge, MA.: MIT Press.

Messier, M. (2011) Sewing Machine Orchestra. Retrieved from http://www.mmessier.com/projects.html.

Messier, M. (2014) Projectors. Retrieved from http://www.mmessier.com/projects.html.

Moholy-Nagy, L. (1922). Production-Reproduction, in *Moholy-Nagy*, ed. Krisztina Passuth, New York: Thames and Hudson.

Morosov, D. (2017). Ivy. Retrieved from http://vtol.cc/filter/works/ivy.

Piggott, J. (2017). Across Fields: Sound, Art and Technology from an Electromechanical Perspective. *Organised* Sound 22 (2), 276-285.

Rose, E. (2013). Translating Transformations: Object-Based Sound Installations. *Leonardo Music Journal, Vol. 23*, 65-69.

Sandborn, P. (2008). Trapped on Technology's Edge. *IEEE Spectrum Vol. 45, No. 4, April 2008*, 42-58.

Zareei, M., Carnegie, D. and Kapur, A. (2015). Physical Glitch Music: A Brutalist Noise Ensemble *Leonardo Music Journal Vol. 25*, 63-67.

Zareei, M., McKinnon D., Carnegie, D. and Kapur A. (2016). Sound-based Brutalism: An emergent aesthetic. *Organised Sound 21(1),* 51-60.

Zielinski, S. (2006). Deep Time of the Media. Toward an Archaeology of Hearing and Seeing by Technical Means. Massachusetts: MIT Press.

Authors Biographies

Paul Dunham is a recent graduate of the New Zealand School of Music, Te Kōkī at Victoria University of Wellington (New Zealand). He has produced a number of sound works across different media. His current interest is in the use of electromechanical devices as sound objects and their use in sound installations. He has exhibited and presented works at The Dowse, Adam Art Gallery, Victoria University (Wellington) and at ACMC (Sydney). His work, *Click*, was a finalist in the 2017 Lilburn Trust NZSM Composers Competition. He holds a Bachelor of Music (Composition) with First Class Honours.

Mo H. Zareei is a sound artist and a researcher. Using custom-built software and hardware, his experiments with sound range from electronic compositions to audiovisual installations. Regardless of the medium, Zareei's work is particularly targeted at the point where noise meets grid-based structures. He has exhibited his work at internationally including ISEA (Vancouver and Dubai), NIME (London), ICAD (New York), ICMC (Perth), Modern Body Festival (The Hague) and Lux Light Festival (Wellington). His installation Rasping Music was the recipient of the 1st Prize for Sound Art in the Sonic Arts Award 2015. Zareei holds a BS in Physics from the Shahid Beheshti University of Tehran and a BFA in Music Technology from the California Institute of the Arts. He recently completed his PhD at Victoria University of Wellington (New Zealand), where he currently teaches.

Creation in Mexican Digital Art

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Abstract

The processes of creation of Mexican digital artists had not been studied so far, there are digital artists but just a small amount of them have worked in the field for more than ten years. This article is about the processes of creation of Mexican digital artists and their work, in order to propose a methodology for new artists and to contribute to the knowledge and comprehension or Mexican digital art. The beginning of the article is a description of the characteristics of the context of the artists; after this, a description of the process of creation according to various specialists in the field in order to propose a focus based on digital art. Then we establish relations between the theory on creation processes and the information provided by Mexican digital artists on various interviews we made. Finally, a Conceptual Map that shows the findings and the links between the eight artists of this research was made.

Keywords

Digital, Art, Mexico, Creation, Stages, Processes, Method, Artists, Context, Development.

Introduction

In artistic processes of creation, it has been demostrated that it is better if the artist works with discipline and liberty, because that contributes to smart and new ideas, the opposite is copying ideas from others.

In this research we separated the process of creation in five stages:

Preparation is when the artist has interests that arose from diverse thoughts.
Incubation / Intuition comes from diverse motivations.
Evaluation is when the artist determines if an idea is worth making or not.
Elaboration is when the artist makes the idea a reality.
Communication is when the artist shows his work to the public.

In order to discover the work processes of Mexican Digital artists, several interviews have been made, as a result of that, analyses was made of data to produce a methodological proposal that new digital artists can use to work with. The artists that were interviewed and analyzed are: Iván Abreu (ABR), Arcángel Constantini (ARC), Rafael Lozano-Hemmer (RLH), Gilberto Esparza (GIL), Leslie García (LES), Erick Meyenberg (MEY), Santiago Itzcoatl (ITZ) y Roberto Morales (ROB).

One of the characteristics that has been detected in this research is that the processes of production are continuous, that means the artistic pieces are the result of the research that the artists have done through years, where one line of interest may produce several pieces.

For example, the digital artist Arcangel Constantini, said he is always studying different subjects and each one of his proyects is part of a bigger series of work. Erick Meyenberg, said that his processes emerge from interests that later on become research. Ivan Abreu, explains he works in projects where he can learn and produce scientific or technological knowledge and Gilberto Esparza said he likes to work in random subjects when suddenly an idea for a piece of art emerges.

That's the reason why we like to explain processes of production of Mexican digital art not like a static line of production, but like a rhizome structure, such as Guattari and Deleuze explain in their rhizome theory[1], this is shown through a Conceptual Map of processes of production of Mexican digital artists.

Context

A common important factor of the artists who are part of this research is that some of them began studying a graphic design carreer (or other carreers related with art and technology), then they abandoned their studies because they felt there was something missing on the carreer contents.

An other feature of this group of digital artists, is that they are capable of solving unexpected problems in very difficult situations. In addition to that, Mihaly Csikszentmihalyi[2], a wellknown psychologist, said creative people have complex personalities, which means that one individual has characteristics of different personalities. That contributes to develop creative ideas, because he can see one problem with many possible and different solutions.

On the other hand, psychologist Abraham Maslow[3], considers there is an important relation between family and formal education and context, for him, those aspects are the

[1] Deleuze, G. Guattari, F. (2009). *Rhizome.* Mexico, Fontamara.
[2] Csikszentmihalyi, M. (2007) *Flow (flow) A psychology of happiness.* Barcelona, Spain, Editorial Kairos. And (1996) *Creativity, flow and the psychology of discovery and invention*. Barcelona, Spain.
[3] Maslow, A. (2005). *The creative personality.* Barcelona, Spain, Kairos.

real contributors for a creative person. In the artists that we observed, we noticed they have important links with science and technology in their childhood or youth.

In all the cases we see migration histories inside (among states of the Mexico) or outside the country, but the only artist who described himself as a Nomad artist is Rafael Lozano-Hemmer, because he lives in three different countries: Mexico, Spain and Canada.

We also observed that just a few artists have worked in a poor environment with few resources, like Leslie Garcia and Arcangel Constantini did at the beginning of their careers. Most of the artists work with goverment or institutional grants, or do commissioned work from galleries and museums.

Creation processes on Mexican digital art

Preparation

Among the aspects considered, this stage is about all the issues that awake the artists curiosity, then questions begin, and a problem-solving process takes place; so this stage is the product of intellectual observation and habits of profound thought.

The group of artists we studied have interests in the following issues, from which might arise different processes of art production: science fiction, animatronics, sound and music, obsolete technology, computers, free software, the human body and characteristics simulated by technology, history, flea markets, among others.

The artists saw the global and the local problems as an opportunity for profound thought through their artistic pieces, sometimes because they want to make some problems visible and they want to invite the public to think about them, or they want to reinforce the identity of cultural groups through their work, -like in Lozano-Hemmer's public art.

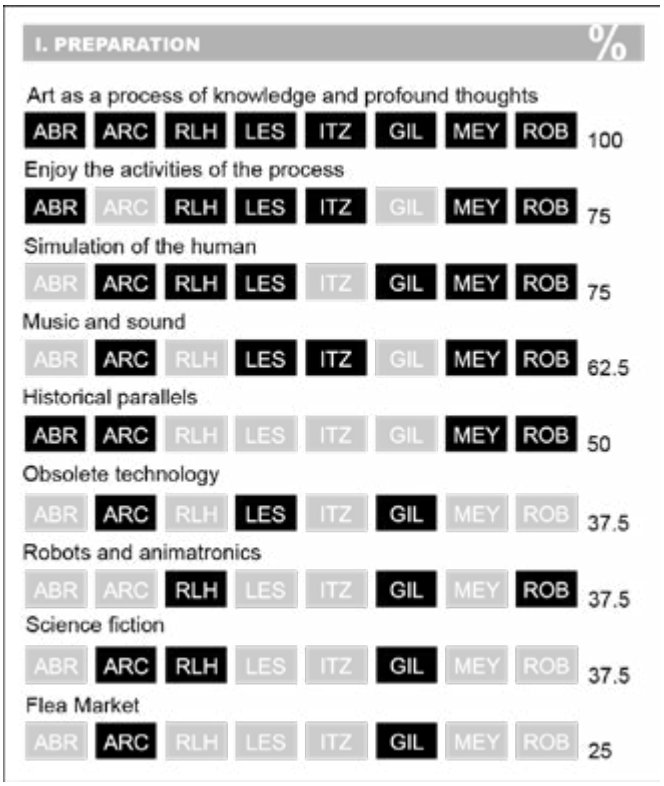

Illustration 1. Preparation Stage, a comparation of results. Artists: Iván Abreu (ABR), Arcángel Constantini (ARC), Rafael Lozano-Hemmer (RLH), Gilberto Esparza (GIL), Leslie García (LES), Erick Meyenberg (MEY), Santiago Itzcoatl (ITZ) y Roberto Morales (ROB).

Incubation / Intuition

Incubation and intuition are two stages of the process of creation that take place simultaneously, in incubation, ideas are taking place on the subconscious side of the brain and intuition is when all the pieces of a problem finally fit and you find a solution.

Apparently, there are ideas that emerge suddenly. However, ideas arise due to time and quality in the artist's training and also from years of continuous work. The digital artist Ivan Abreu said that sometimes the ideas just arrive because you have been looking for them, other times because you just use the ideas that you already had and addapt them to the work, however he always starts a work of art for the substance (the meaning) not for the appearance.

In this stage of the process, some artists use meditation and day dreaming as a resource to generate ideas, because these processes induce brain conditions for this stage: incubation takes place in the subconscious side of the brain.

It is necessary to say that all stages of the creative process are linked, for example, in Preparation stage we talked about interests, but those interests become motivations in Incubation stage. Mexican digital artists find inspiration for their work in: consumerism, obsolete technology, urban environment, math, chaos, uncertainty, everyday rush, meetings with other artists and professionals of other areas, scientific research papers, viewing related non artistic things, environment, natural resources, energy and their uses, typography as an element, economy and technology in everyday life, psychotherapy, sketches, among others, like those related with human rights, racism and international relations with U.S.

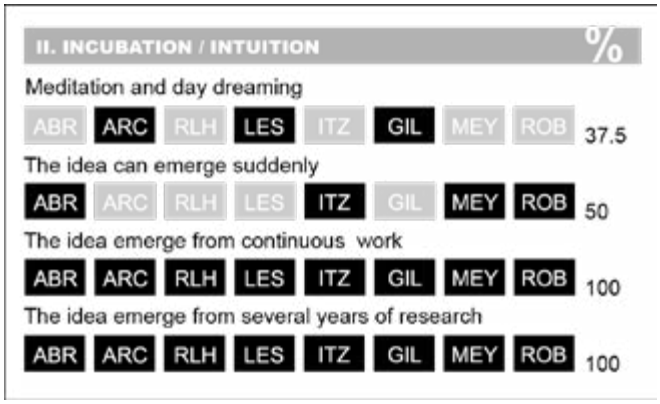

Illustration 2. Results of Incubation and Intuition stages.

Evaluation

One of the problems in the creative process is to decide which idea is the best, in other words, the real problem for artists is to choose the best idea worth the time that they are going to spend in developing it.

This stage was hard to research because the creative processes are not linear, that means several processes might be taking place in the mind of the artist, the stages do not take place in order, plus some pieces were made more than a year ago, so most of the artists did not recall precisely how or when they decided to make it.

However, the mayority of the artists that were studied said they decided to develop an idea based on the knowledge they produce and acquire during the process. Others say they often ask themselves 'why', 'how' or 'what for' before they decide to develop an idea. In other cases, they decide to choose an idea by intuition, they trust their hunches. In some occasions they consult colleagues, search for more information on the Internet and books, read about the subject, and for example Leslie Garcia said that, if she feels the urge to talk more about the subject with her team, it's a sign that she has to do it.

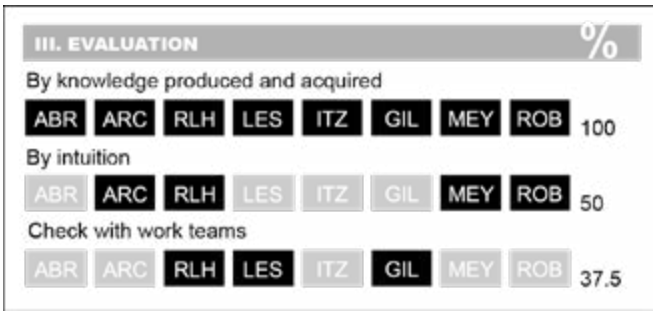

Illustration 3. Results of the stage of Evaluation.

Elaboration

This stage is where the execution of the idea takes place, which means the artist begins a phase of intense work with many problems he has to resolve and the development of a wide network of relationships with professionals of other areas who will contribute to the project. It is observed that most projects congregate professionals from other areas: engineers, photographers, manufacturers, programmers, architects, linguists, writers, composers, actors, astronomers, philosophers, biologists, researchers, communicators, designers, animators, therapists, diverse assistants and other artists.

The artist will be tested for his capacity for work and discipline, because in this stage he has to improve the art piece or pieces, so patience will be required; it is common that during the elaboration, the artists espend many hours working without noticing the time. Some of them mentioned they begin the project thinking of the main statement of the piece, not in the appearance.

Most of the artists mentioned that they are involved in projects which duration goes from weeks to years, and even some of their works remain open (they like to refer to them as artistic developments instead of a piece of art), that means they make endless projects; that is the case of "Bakterias" (1996-through now) from Arcangel Constantini.

Many of the artists said they do not work thinking about finished pieces, but with pieces that can be the beginning of others. In certain circumstances a project could stop due to technological limitations, physical exhaustion of the creator or by economic constraints.

The mayority refers they work for the audiences to understand the messages on their pieces, however, the artist prefers the final results to be undetermined and with

different results, depending on the way the public decides how to interact with the artistic project.

It is interesting to mention that artists like Leslie Garcia or Erick Meyenberg, write and draw thorough journals before and during the creation of the pieces, in which they register important data about the development of the project, like errors, successes and all the information that forms the corps of the artistic work.

Another project form of elaboration is the one that artist Leslie Garcia describes like processes of continuous work which correspond to research developed during years. Also, she said, sometimes she works while she is visiting other artists in other cities or countries, that is an exercise of flexibility, because she has to adapt her way of working to different conditions, plus there is dialog on interests, proposals and ideas.

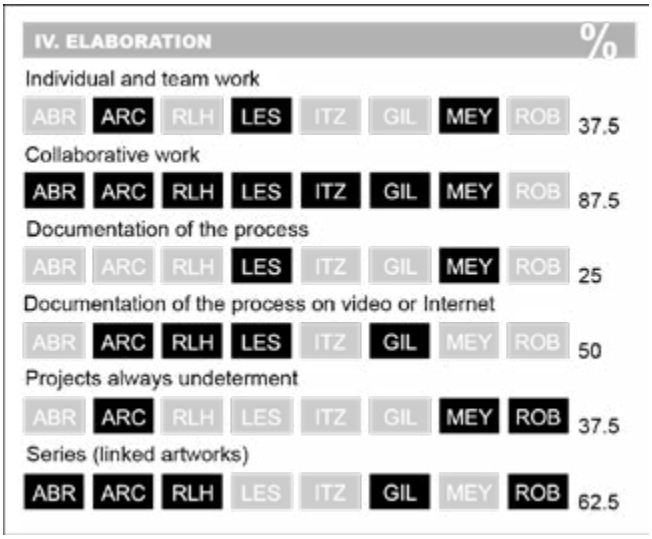

Illustration 4. Results of Elaboration stage.

Communication

In accordance with psychologist Mauro Rodriguez Estrada[4], some of the artistic projects are developed just as an exercise, or because the artist enjoys the process itself, in whatever way, the common situation is the artist wants the piece to be shown to the public; that is one of the most important motivations of doing it: to communicate.

Ivan Abreu, for example, searches for a positive reaction from the participant of the piece, he calculates the relevance of his art through the memory of the work by the spectator and/or participant; he likes his pieces to be remembered, because that means he achieves awareness of the person who interacts with his work. In the case of Arcangel Constantini, he searches for physical or mental reactions in his audience. Rafael Lozano-Hemmer said, that the public completes or finishes his pieces, which means he left his art works undetermined in such a way that thousands could interact physical or virtually. Gilberto Esparza searches for a change in the audience through profound thoughts. Leslie Garcia mentions that her pieces are like archetypes, regardless of how, they are not always understood by the public, she says there is interest to try an interaction with the pieces, any way her works have been made with austere materials and processes, which connects with Latin American audiences who live in permanent austerity also. In the case of Roberto Morales, he establishes direct and playful communication with the public because he presents music improvisation with both technology devices and traditional instruments, so his movements depend on the reaction of the public. For Erick Meyenberg, the thoughts on the aspects exposed in his work are essential. Finally, Santiago Itzcoatl refers he enjoys the reaction of the public. However, it is not his main intention to communicate something specific… he does, but it is not his main purpose.

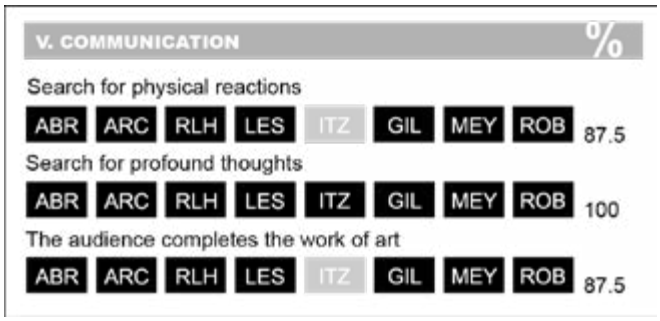

Illustration 5. Results of the Communication stage.

[4] Rodríguez, M. (1985). *Creativity Handbook. Psychic processes and development.* Mexico City, Editorial Trillas.

Illustration 5. Conceptual Map about the coincidences on the production processes between the eight Mexican digital artists of the research.

Conclusions

The processes of creation are often hidden by a halo of mistery, the research on these processes contributes to increase the knowledge of the field, by doing this, we create a methodology of work in this 'new' area of Mexican art[5].

Then we conclude, that there are no studies with the characteristics we have shown here, that Mexican digital artists do not work only in digital art, some of them also described themselves as electronic artists, and just two of them are contemporary artists with digital art works.

In relation to the context, Mexican digital artists have certain circumstances that relate them to science and technology, by family or close friends who introduce the artists to the subjects. The ones who live in Mexico, began their work in austere conditions, with limited resources, but now, the artists part of this research work with financial support, grants, among others.

We can conclude that in the processes of production of Mexican digital artists in Preparation stage, their interests are related with their most profound thoughts or even worries, in such a way that Incubation and Intuition take place surrounded by multiple interests, this makes tha Evaluation stage more complex, because the problem is not to generate ideas, the problem is choose which is the best one, due to originality, novelty, but also possible to develop, so that Elaboration stage can conclude succesfully.

Acknowledgements

Thank you to PhD. Francisco Giner Martínez, to University of Guanajuato México and The Universidad Politécnica de Valencia, Spain.

References

Benjamin, W. (2003). The work of art in the time of its technical reproducibility. Mexico City: Editorial Itaca.

Csikszentmihalyi, M. (2007) Flow (flow) A psychology of happiness. Barcelona, Spain: Editorial Kairos.

———(1996) Creativity, flow and the psychology of discovery and invention. Barcelona, Spain.

Deleuze, G. Guattari, F. (2009). Rhizome. Mexico: Fontamara

De Quesada, E. (2002). Creation and design, the method in design and other arts. Valencia: Institution Alfons the Magnani Diputació of Valencia.

Gardner, H. (1995). Creative minds an anatomy of creativity. Barcelona, Spain: Paidós.

Hernández, R., Fernández, C., Baptista, P. (2010). Investigation methodology. Mexico City, Mexico: McGraw-Hill / Inter-American editors.

Lieser, W. (2009). Digital art. Cologne, Germany: H. F. Ullman.

———(2010). Digital art, new paths in art. Potsdam, Germany. H. F. Ullmann. P.

Malvido, A. (1999). By the digital path. Mexico. CONACULTA.

Marina, J.A. (2006). Theory of creative intelligence. Barcelona, Spain: Anagram.

———(2004). Praise and refutation of the wit. Barcelona, Spain: Compact Anagram.

Maslow, A. (2005). The creative personality. Barcelona, Spain: Kairos.

Paul, C. (2008) Digital Art. London: Thames & Hudson.

Popper, F. (1993). Art of the electronic age. New York, United States: Thames & Hudson.

[5] An extended version of the topic of this research has been made by the author and is located at: Librería UPV. http://www.lalibreria.upv.es/portalEd/UpvGEStore/products/p_5836-1-1 *Análisis de procesos de producción artística digital en México: artistas digitales mexicanos y su obra*.

Romo M. (1997). Psychology of creativity. Barcelona, Spain: Paidós.
Rodríguez, M. (1985). *Creativity Handbook. Psychic processes and development.* Mexico City, Editorial Trillas.
Rush, M. (2005) New media in art. London, England, Thames and Hudson.
Shanken, E. (2009). Art and electronic media. London, England, Phaidon.
Villagomez, C. (2010). Methods of creativity applied to graphic design and visual arts. Guanajuato, Mexico, University of Guanajuato.
Villagómez, C. & Giner, F. (2017) *Análisis De Procesos De Producción Artística Digital En México: Artistas Digitales Mexicanos Y Su Obra*. Spain, Universitat Politècnica de València. Departamento de Escultura - Departament d'Escultura. (n.d.). http://www.lalibreria.upv.es/portalEd/UpvGEStore/products/p_5836-1-1
Wands, B. (2007). Art of the digital age. New York, United States, Thames and Hudson.
Zinker, Joseph (2004). The creative process in Gestalt therapy. Mexico, Paidós.
Interview with Archangel Constantini by Cynthia Villagómez at Fonoteca Nacional, Coyoacán, Mexico City. October 1, 2011. Video Interview Length 00:21:43.
Interview with Leslie García by Cynthia Villagómez (video conference), January 15, 2013. Duration 01:09:41.

Author Biography

Cynthia Villagomez Oviedo is a Professor and Researcher at Guanajuato University in Mexico since August 2002. She is the author of three books, several book chapters and articles about Art, Digital Art, Creativity and Design. Since 2003 she is the editor of the magazine called *Revista Interiorgrafico de la División de Arquitectura, Arte y Diseño de la Universidad de Guanajuato*. Has made stays in Spain and Austria, linked to the research she has been developing. Has a degree in *Graphic Design,* a Master degree in *Creativity for Design* by The Design School of The National Institute of Fine Arts. Has a PhD on *Visual Arts and Intermedia* from Universidad Politécnica de Valencia España, her thesis about Mexican Digital Art received an award called *Premio Extraordinario de Tesis Doctorales* by Universidad Politécnica de Valencia in 2016. She is a former Member of The National Research System, level 1, CONACYT.

(Re)coding the past for the future

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Keywords

Cultural heritage, (de)colonialism, 3D scanning and printing, media art, digitization, archaeology, oil

Abstract

In light of increasing social unrest and wars around the globe, a growing number of not-for-profit organizations and commercial businesses are trying to fill the gaps that befall cultural heritage sites due to bomb strikes and looting. 3D scanning and printing are among the main vehicles to restore cultural heritage by generating detailed copies of an artifact, building or even site. In terms of accessibility and preservation there are undeniable benefits, but in what ways do these technologies affect cultural heritage politics? While commercial businesses profit from selling copyrighted files, or by providing restricted access, several artists' initiatives try to counter these practices. Even though they use similar technology, their aim is to empower people by giving them control over their lost heritage. These 'decolonial' practices signify a desire to overcome or resist a colonial conditioning, favoring collaboration and freely sharing over individual and/or monetary gains. In the process, such examples challenge the conventional meaning of value, which is dictated by the market and based on copyrights around authorship and ownership. Instead what is valued and becomes valuable is belonging to a wider community in which control over (re)use is embedded in the network.

Introduction

Trafficking of cultural heritage is nothing new. It ranges from the looting of archaeological sites, theft from cultural heritage institutions and private collections, to the displacement of artifacts due to war. Recently a new tactic was added to this list: filming the destruction of 'fake' ancient relics, while the originals are quickly and illicitly traded on the profitable market in ancient artifacts. Following the release of videos depicting the 'scene' by ISIS, many outraged Western nation states responded by claiming the preservation or rebuilding of some of the remains, ignoring their own role in these (fake) demolitions, and reinstating conventional methods of appropriation. At the same time, a new player entered the marketplace: commercial companies specializing in the 3D modeling and printing of ancient statues.

The possibility of generating detailed copies of an artifact without having to physically engage with it brings undeniable benefits in terms of its accessibility and preservation. It allows people access to lost 'treasures': a digital model can capture the appearance and shape of an object in a way that a 2-dimensional representation could never do. But do these technologies affect cultural heritage politics? Rather than being committed to the preservation of cultural heritage it could be argued that commercial companies profit from selling copyrighted files. Drawing attention to the importance of a freely shared memory and the power of technology, I focus on several practices that counter these practices. While using similar tactics their aim is to empower people who have lost their heritage, thus proposing a decolonialist practice. These methods signify foremost a desire to overcome or resist a colonial conditioning, favoring collaboration and sharing over individual and/or monetary gains. In the process, such examples challenge the conventional meaning of value, which is dictated by the market and based on copyrights around authorship and ownership. Instead what is valued and becomes valuable is belonging to a wider community in which control over (re)use is embedded in the network through which ideas, objects and methods circulate as a produced, shared, and distributed resource.

Recognizing that the term 'decolonial' might too closely reference the period of actual decolonization when nation

states loosened their hold over their colonies, the prefix 'post' that is often used, denies what is still present: a power imbalance now perpetuated by the use of high-end technologies. Decolonialist efforts show why it matters when tech companies or influential Western institutes conserve or rebuild cultural heritage, rather than someone who was directly affected by the destroyed or otherwise lost buildings and artifacts. In this way, old questions remain urgent. By exploring several examples I hope to answer one of them: how are cultural memories produced and configured, to whom do they belong, what power structures do they embed, and what values do they engender?

Giving form and shape to the invisible

The use of digitization techniques moved from the initial digitization of paper, photographs and forgotten objects in museum collections to developing detailed 3D models from existing, damaged or destroyed artifacts, statues or even archaeological sites. In some cases these techniques have been used to test the boundaries of art and heritage collections, such as Oliver Laric with his project *Lincoln 3D Scans* (2012) [Fig. 1], which he developed at the invitation of The Collection in Lincoln. The project can be seen as a continuation of Laric's earlier works, for example, *Kopienkritik* (2011) and *Versions* (2009-present) in which he questions the value of copyright and ownership. At times entertaining and fun to see, the projects are interesting and provocative in discussions about copy vs. original, appropriation and the value of authenticity. As Laric says of his latest attempt, *Lincoln 3D Scans*: 'the project aims at making the collection available to an audience outside of its geographic proximity and to treat the objects as starting points for new works'.[1] Scans of objects in the collection can be downloaded copyright-free from a dedicated website, and new versions are presented in the online gallery. The collection is still growing and shows how Laric's method of freely sharing and re-using inspires many to continue the creative process and give new meaning to the objects. Such 'radical' appropriation is less visible in more traditional museums and archives. While these might provide access to their collections and even to free downloadable 3D scans, institutes that allow the public unrestricted access to their objects are rare. Often what is available are simplified models or merely a small selection of everything that is scanned. On the one hand, this brings out the dilemma of power: losing control over their objects is not something most collectors are willing to risk. Yet, it needs to be acknowledged that high-quality 3D scanning is still an expensive process that not everyone has access to.

This became clear when in December 2015 two artists, Nora Al-Badri and Jan Nikolai Nelles, presented 'The Model Unwrapped' [Fig. 2] at Europe's largest hacker event, the Chaos Computer Congress in Berlin. They placed a 3D model of a bust of Queen Nefertiti from the Neues Museum in Berlin online that could be downloaded for free and used. They claimed the scan was made with a mobile device (Wilder 2016), but the quality of the scan cast doubt on whether or not the scan was genuine. The project, which became know as 'The Other Nefertiti', attracted widespread attention and became a discussion point for professionals.[2] Setting the discussion about the genuineness of the scan aside, the goal of the artists was to return the statue from the Neues Museum in Berlin to Cairo. Although the Nefertiti bust is one of the most copied objects from ancient Egypt, which imbues any discussion or use with additional excitement, for the artists it 'represents all the other millions of stolen and looted artifacts all over the world currently happening, for example, in Syria, Iraq, and in Egypt'.[3] Since the museum does not allow direct access to the statue the artists' aim was to make it public again, as they state on the website: 'With the data leak as a part of this counter narrative we want to activate the artefact, to inspire a critical re-assessment of today's conditions and to overcome the colonial notion of possession in Germany'.[4]

Besides important issues of technical capabilities and copyrights, what this example highlights is the call for provenance. Provenance is a fundamental principle in archival and conservation practices but is

increasingly important in situations where there is little oversight of where the information comes from and who approved it. One way to ensure a more reliable process of provenance could be to open up to the public instead of obstructing access – as Laric emphasizes – and also allowing people to set the terms. As Bethany Nowviskie, Director of the Digital Library Federation, argues, this includes 'actively configuring classification systems, search-and-discovery interfaces, or other tools to express independent narratives of the world' (Nowviskie 2016). Examples can be found in activist attempts, for example, in projects where a reconstruction becomes a political and social vehicle to address misconduct (the project *Saydnaya* by Forensic Architecture in collaboration with Amnesty International), or where data is crowd-sourced for use as evidence in potential future trials (*The Syrian Archive*).[5] What these projects share is a desire to use technology as a tool to make visible and open up content or conduct that is neglected, forgotten, discarded or deliberately concealed. In this way, it makes sense, as also Nowviskie points out, to 'take the notion of cultural heritage not as content to be received but also as technology to be used'. This means that artifacts and events are no longer merely about the past, but become tools that can be used to imagine alternative pasts and futures (Nowviskie 2016). Several major initiatives have been started in recent years to provide access to destroyed cultural heritage. Perhaps one of the best known is Google's project *Wonders of the World* (2012-present).

Digitization and modern colonization

In continuation of Google Street View, in 2011 Google set up Google Art Project (in 2016 renamed Google Arts & Culture). The project is dedicated to showing the interiors of art and heritage institutes (Sood 2011). Initially employing the same technology as used in the Google Street View Car, with the development in 2016 of highly specialized digitization techniques (referred to as the Google gigapixel art camera), people can move through the gallery and zoom in on specific paintings or objects. At the highest resolution, the faintest paint strokes and the minutest cracks in the paint can be seen: details that would be hard to discern in the museum itself. Preceding the success of Google Art Project in November 2009, Google made a public manifestation of their digitization project of the collection of the Iraq National Museum in Baghdad, owner of the finest Mesopotamian collections in the world.[6] According to Google's chief executive Eric Schmidt the aim was: 'to make the images and the ideas of [Iraq's] civilization available to all the people of the world' (Nordland 2009). Although perhaps responding to the international indignation at the plundering and destruction of many objects in the museum a few years earlier, in particular in 2003 after the American invasion, Google's initiative nevertheless provoked controversy and debate around the world.[7] Even though Google stated that they would bear all the digitization costs, such philanthropy often comes at a price. Google's endeavor to digitize the 'treasures of the world' enables many to see things they otherwise never would, but it also raises several questions, for example, what happens when people are referred to corporations instead of public institutions for such information and services?

All corporations exist to make a profit, and in the case of Google this is by providing third parties with access to Web users, and profiting from charging for that access.[8] To attract users Google needs content. Through content it can generate traffic, track users and generate even more data.[9] Data and database structures are what make Google different from archives and museum collections; together these comprise a carefully built entity for preserving culture and memory, while a database reacts to input and searches for information by making the most efficient connections. The more data there is the better the connections and predictions become, and the more profitable it is. It is therefore not surprising that Google wants its users to remain inside their website. Inside Google Cultural Institute you can do all kinds of things with the material – zoom in and out, rotate, make selections, curate your own exhibition framed by your own descriptions, and invite friends to come and see it – but you cannot download the information, place it on your own website, share it, or re-use it. For that would mean that

Google no longer controls the data, losing it revenue. Many refer to this type of technology-enabled access as a new form of colonialism: a commercial, digital or techno-colonialism. Some even compare this to the motivations behind previous colonial collections, where profits were made from privileged access to certain kinds of information through exploration, discovery and collecting (Juarez 2017).

Recently several counter-movements have started, for example, the non-governmental collaborative initiative #NEWPALMYRA which collects data from international partners, and uses it to create a digital reconstruction of Palmyra. They present workshops about the process and share the models and data in the public domain. The project is not to be mistaken for the reconstruction and exhibition of Palmyra's Arch of Triumph in Trafalgar Square in London for World Heritage Day in April 2016. This project gave little credence to the complex history and context of the artifact. Moreover it reiterated and reinforced a colonial mindset, reasserted by Boris Johnson, when he was Mayor of London, in which Western society is portrayed as civilized and other societies, in this case Muslim, as 'barbarians' (Brown 2016). As critics observed, the role of the West in the rise of ISIS, which led to the destruction of these statues, was ignored. In this sense, and as also concluded by archaeologist Nour Munawar: 'reconstruction can be as destructive as the destruction itself' (Munawar 2017).

Regaining control over cultural heritage

Similar criticism can be found in the work of Iranian/American artist Morehshin Allahyari. In her project *Material Speculations: ISIS 2015-2016*, she uses 3D modeling and printing to reconstruct relics that ISIS destroyed in Iraq [Fig. 3]. The work was motivated by the videos that ISIS released of the destruction – or at least removal – of many objects in the Mosul Museum in Iraq and of the ancient statues and artifacts in the 2000-year-old UNESCO World Heritage Site around Hatra and in Nineveh, an ancient Assyrian city of Upper Mesopotamia. Thinking of a way to counter their acts, and reflecting Boris Buden's appeal to 'make the memory a site of political struggle, or better, a political cause' (Buden 2014:8), Allahyari recreated twelve statues and artifacts as a way to provide 'a practical and political possibility for artifact archival, while also proposing 3D-printing technology as a tool both for resistance and documentation'.[10] Based on extensive research and discussions with archaeologists, historians, and Mosul Museum employees, she gathered as many images, videos, and maps about the artifacts as she could. However, lacking the material needed to create a 3D visualization, she created her models from scratch based on the images in exhibition catalogues, tourists' snapshots and her imagination. She placed a flash drive and memory card with all the research inside each of the printed resin models, creating 3D time capsules: data included the artifact's history and background, details of its destruction; the 3D file of the object; the documentation of Allahyari's modeling and printing process; the e-mail correspondence with specialists; a list of literature she consulted; and ISIS' self-published videos of their demolition.

The objects are created by 3D printing the models in resin layer by layer. UV light hardens the material into a translucent object. Some attribute a ghostly quality to the objects that 'evokes the dynamics of presence and absence, lost and found, disappeared and reappeared, ancient and contemporary' (Sandals 2016). Speculating on the past and the future Allahyari moves beyond a merely metaphoric gesture by making the different models and research available for download. By allowing people to print their own copy and construct their version of the past, she proposes a new method for the 'reconstruction' of history. By placing the 'reconstructions' between quotation marks, Allahyari emphasizes that these are not real replacements, because she believes there is no 'honest way that one can replace these artifacts' (Lorenzin 2015). Rather then preservation she regards her projects as a form of transformation suggesting a continuation of the destroyed objects.

In light of discussions around iconoclasm, the project could be seen as

reinforcing Western values of cultural heritage,[11] in which instead of idolatry, the collecting and presentation of (sacred) artifacts is accepted as the preservation of the past for educational, cultural or scientific purposes.[12] In their videos of the destruction of sculptures and artifacts, ISIS repeatedly includes quotations from the Qur'an condemning the worship of any type or form of physical derivative of the immaterial God. In line with Sunni Islamic tradition, also strictly adhered to in Saudi Arabia which follows the Salafist branch and where consequently all statues and cultural heritage are (quietly) being destroyed,[13] it could be argued that their destruction merely reflects 'a consistent objection to religious mediation, whether as spiritual aspiration or material practice' (Flood 2016, 118). However, ISIS' use of video and photography to record the destruction, and their distribution over the Web as a religious act is only one part of the story. At the same time, their actions of 'image-smashing and image-creation' are closely following the trend in contemporary warfare to depict and fight a war through images (Mitchell 2011).[14] This is strengthened by analysis of the videos which shows that it is likely that some the statues and structures were simply replaced with plaster models before being blown up, while in the meantime the real objects were illicitly traded (Stubblefield 2016). Similarly, Western museums neutralize public icons and other religious artifacts by turning them into art, making them highly profitable entities (Gell 1998). Not surprising, the destruction of such value (monetary and cultural) generates a lot of attention, outrage and counter acts in which the statues and their physical and digital reconstructions circle around in perpetuity gaining in value with every cycle. At the same time, shown in cities far from their origin or only accessible behind high pay walls, they disappear from public sight and use. National regimes, public museums, international commerce and terrorist groups are all implicated in hijacking cultural heritage for polemical purposes.

Providing a practical and political alternative archival method for endangered or destroyed artifacts with her project *Material Speculations: ISIS*, Allahyari tries to expose the hypocrisy inherent in the inconsistent (re)actions of the different parties involved in cultural heritage. While acknowledging using similar tactics as ISIS, she says: 'The objects we researched for *Material Speculation: ISIS* are now free to flow as zeroes and ones; as digital files. And those files can be altered, edited and reconstituted in countless materials – or no materials at all – able to jump across continents and cultures as easily as the videos of ISIS carrying out their destruction in the first place' (Lorenzin 2015). It could be said that she participates and perpetuates the narrative of cultural heritage, but Allahyari clearly resists the symbolic and economic value attached to the original or authentic object by open sourcing her research and files. On the one hand, by creating a free and shared system, Allahyari challenges conventional Western methods of preserving history, while on the other, by proposing 3D-printing technology as a tool for resistance as well as documentation, the project reflects the hope that technology will help to fill the gaps caused by the ongoing destruction. However, by distributing the project in open source it is also a critique on the proprietary infrastructure in which most 3D printing is now controlled by Western tech companies who own the copyright on much of the world's cultural heritage – or as Google framed it 'the treasures of the world'. As mentioned, the wording, the exclusivity and the hierarchies that are presented within these constellations highlight a modern version of colonialism that instead of nation states is now performed through technology and commercialization. In an attempt to explore methods of de-colonization, Allahyari offers a counterexample in which inherent qualities of technology such as easy distribution and sharing are part the work rather than merely tools that also empower the disempowered in the process. Whereas Google Cultural Institute and many other commercial 3D companies lack a defined or ethical position towards the material they use, Allahyari shows the importance of the 'social life' of things.[15] By documenting and presenting the social and cultural changes the objects have endured, she emphasizes how they acquire value and meaning. This process of value and evaluation is no longer fixed, but

moves and changes with every new iteration, thus not only averting destruction but also opposing imposed systems of description and classification. Rather than attempting to preserve cultural heritage Allahyari provides forgotten or destroyed objects, and their users, with agency to re-act in the world.

Oil

When asked to exhibit the project Allahyari suggests, among others, to create miniature models in real time by using a small customer 3D printer. If they wish the visitors can take the results back home. While this gives prominence to the distribution of the concept and the project, it also introduces the issue of using plastics, and in particular the debate around the black liquid of oil. Petrochemicals form the basis of many of our daily goods and while Allahyari applies the problematic 3D scanning and printing of many Western cultural heritage projects in the service of an alternative model, the ethics of the use of raw oil for 3D printing bring up other concerns. One of the main criticisms is that the contested fossil is at the root of many of the conflicts that Allahyari tries to critique. However, this is not something she has overlooked. *Material Speculations: ISIS* is also part of another project that Allahyari initiated with Daniel Rourke, *The 3D Additivist Cookbook*. The project explores the ethical implications of 3D printing. They coined the term #additivism, a merge of 'additive' (the technical term for the 3D printing process) and 'activism', to reconsider 3D printing as a medium. Rather than looking for ways to recycle existing material, and taking inspiration from among others Donna Haraway's notion of the Chthulhucene (2015), they want to focus attention to the urgency of the problem by addressing the core of the issue: people's relentless dependency on oil. As Allahyari mentions: 'Let's embrace this shitty thing we are living in instead of thinking about solving solutions solely from that environmentalist, singularity way of thinking about the future. Let's think about the horror we are already in, embrace the plastic, and think about another way to deal with it' (Simensky 2015). But what happens when substituting decolonial with peak oil?

Petro-networks are extensive and their flows and leaks connect in many ways. Several artists (groups) have protested against the use of the so-called 'social licenses to operate' by companies such as BP and Shell who have large sponsorship deals with prestigious museums and cultural institutions [16]. Whereas it has become socially unacceptable to connect anything to tobacco industries (who were playing major roles before), oil pertains a more obfuscated image, which is partly due to its seeping nature that perpetuates itself in multiple shadow economies while surfacing in manifold social realities.

Rather than repressing or looking for other solutions, perhaps there is indeed a need to seize oil at its most vulnerable spot: in the unobtrusive and insipid everyday products, in affective and seductive objects, and in its exotic allure. Exploring these combinations and legitimating them as necessary evil, forces us to reconsider its consequences.

Conclusion

Overshadowed by political, social or even humanitarian issues cultural heritage has become a global business, in which conflicting acts and paradoxical statements constantly succeed each other. In an attempt to give control back to those whose heritage has been taken, some artists challenge the authority over world heritage. In these practices cultural heritage is presented as an open-ended process characterized by transformation, collaboration and sharing. In such an environment, an archive or collection is created in collaboration with communities and users, favoring local knowledge over standardized metadata and categorization. It supports a sense of belonging that is rooted in social exchanges and where value is placed on sustaining productive relations rather than on the objects. This dynamic model considers the network of ideas as a resource that is produced, shared and distributed, while giving credence to all involved. Such a method of exchange will reveal opposing versions of the past and entice thinking about new values and shape decision-

making. This process is not merely focused on sustaining what is made, but supports speculation and unrestricted re-making. This implies looking at cultural heritage in the future tense: rather than focusing on what someone else decided, what can emerge through its renewed use. It also requires the expertise of archivists, conservators and archaeologists to revive the process once initial interest fades or is threatened, or to mediate between systems and users. To enable this, it is imperative to comprehend and own the infrastructure that is available in order to experiment and apply the potential of technology in the best way possible.

References

[1] http://lincoln3dscans.co.uk/. The scans can also be downloaded from My Mini Factory; a website that launched in 2013 as a curated social platform for 3D printable objects with the aim to "empower creators to share digital objects with 3D printer owners around the world" https://www.myminifactory.com/.
[2] See, for example, Voon (2016).
[3] Al-Badri, cited in Voon (2016).
[4] http://nefertitihack.alloversky.com/. Accessed August 15, 2017.
[5] See http://www.forensic-architecture.org/case/saydnaya/ and https://syrianarchive.org/.
[6] A few months before Google's announcement, Italy's National Research Council presented their online vision of the museum's collection to show the history of Iraq and interpret its historical and cultural contribution to global cultural heritage (their digitization efforts were made possible with an extensive grant of nearly one million euros from the Italian Ministry of Foreign Affairs). Italy's efforts could be seen as highly selective, as they wanted to share a particular point of view, showing only certain aspects of the museum and its collection. For more information, see: http://www.virtualmuseumiraq.cnr.it/prehome.htm.
[7] Art historian Thomas Stubblefield (2016) provides an interesting perspective on the way iconoclasm is made affective in today's warfare. Giving a detailed analysis of a series of demolitions in Iraq and the way they were subsequently portrayed and disseminated through mainstream media shows how these acts advance specific political agenda of terrorists and regimes.
[8] It is noteworthy to point out that Schmidt's visit to Iraq was 'part of a delegation, led by Peter Pace, the former chairman of the Joint Chiefs of Staff [US Marine Corps], to encourage business development in Iraq' (LaVallee 2009).
[9] For an in-depth analysis of Google Cultural Institute and their cultural endeavor in relation to their business model read 'Powered by Google: Widening Access and Tightening Corporate Control' by Schiller & Yeo (2014).
[10] http://www.morehshin.com/material-speculation-isis.
[11] Allahyari is fully aware of this tension, and uses it to her advantage. For example, in the public zip of *King Uthal* she titled each of the images in the 'Destruction Images' file, which when read in succession say: Ultimately.the.only.way.to.stop.the.destruction.of.Iraq.and.Syria's.cultural.heritage.is.to.stop.the.socalled.War.on.Terror.and.the.military.invasion.of.the.MiddleEast.Because.everything.is.a.cycle.and.nothing.can.be.truly.done.without.breaking.this.Cycle.
[12] This perspective is taken up in many other non-Western countries and also by most Islamic countries, the main discussion in the latter belief system is still around 3D statues. For more information, see Flood (2016).
[13] See, for example, Osser (2015), and on the legality of destroying cultural heritage, see Wangkeo (2003). At the same time, Saudi Arabia has organized several traveling exhibitions of pre-Islamic sculptures and other antiquities from its heritage (Flood 2016).
[14] Art historian of Islamic cultures Wendy Shaw proposes an additional way of considering the videos. Regarding them as creative acts rather than a (war) crime, and analyzing the narratives that give the destruction its power, she argues, might provide 'a more inclusive, more complex understanding of archaeological legacies beyond the paradigm of universalism'. From such a perspective, she says, 'the video documentation of the destruction of the Mosul Museum becomes an act of creative destruction, suggesting modes of heritage as invested in the local as the global, in absence as in presence, and in listening against the grain to the multiple messages vested in symbolic action' (Shaw 2015).
[15] I borrow the term 'social life' from Seely Brown and Duguid. In their book *The Social Life of Information* (2000), they argue for a stronger emphasis on the context of social networks around information. Information, they argue, only acquires meaning through social context.
[16] See for example the resources on the activist and education research platform 'Platform', http://platformlondon.org/oil-the-arts/.

Bibliography

Brown, Mark. "Palmyra's Arch of Triumph recreated in Trafalgar Square," *The Guardian*, April 19, 2016. Accessed August 15, 2017. https://www.theguardian.com/culture/2016/apr/19/palmyras-triumphal-arch-recreated-in-trafalgar-square.

Buden, Boris. "Cultural Heritage: The Context of an Obsession." In *Art and the F Word. Reflections on the Browning of Europe*, edited by Maria Lind, What, How & for Whom/WHW, 37-76. Berlin: Sternberg Press, 2014.

Flood, Finbarr Barry. "Idol Breaking as Image Making in the 'Islamic State'," *Religion and Society: Advances in Research* 7 (2016): 116-38.

Gell, Alfred. *Art and Agency: An Anthropological Theory*. Oxford: Clarendon Press, 1998.

Haraway, Donna. "Anthropocene, Capitalocene, Plantationocene, Chthulucene: Making Kin," *Environmental Humanities*, Vol. 6 (2015): 159-65.

Juarez, Geraldine. "Intercolonial Technogalactic. Organising Information is Never Innocent." In *Intercalations 3: Reverse Hallucinations in the Archipelago*, edited by Anna-Sophie Springer and Etienne Turpin. Berlin: K. Verlag and and the Haus der Kulturen der Welt, 2017.

LaVallee, Andrew. "Google CEO: A New Iraq Means Business Opportunities," *The Wall Street Journal*, November 24, 2009. Accessed August 15, 2017. https://blogs.wsj.com/digits/2009/11/24/google-ceo-a-new-iraq-means-business-opportunities/.

Lorenzin, Filippo. "Spread What Has Been Destroyed: Interview with Morehshin Allahyari," *Digicult*, September 2015. Accessed August 15, 2017. http://www.digicult.it/news/spread-what-has-been-destroyed-interview-with-morehshin-allahyari/.

Mitchell, W.J.T. *Cloning Terror: The War of Images, 9/11 to the Present.* Chicago, IL: University of Chicago Press, 2011.

Nordland, Rod. "Google Chief Announces Plan in Baghdad to Put Iraqi Artifacts Online," *The New York Times*, November 24, 2009. Accessed August 15, 2017. http://www.nytimes.com/2009/11/25/world/middleeast/25iraq.html.

Nowviskie, Bethany. "Speculative Collections," October 27, 2016. Accessed August 15, 2017. http://nowviskie.org/2016/speculative-collections/.

Osser, Edik. "Why is Saudi Arabia destroying the cultural heritage of Mecca and Medina?," *The Art Newspaper*, November 19, 2015. Accessed August 15, 2017. http://theartnewspaper.com/comment/comment/why-is-saudi-arabia-destroying-the-cultural-heritage-of-mecca-and-medina/.

Sandals, Leah. "The Artist Who Reclaims What ISIS Has Destroyed." *Canadian Art*, February 11, 2016. August 15, 2017. http://canadianart.ca/features/artist-reclaims-isis-destroyed/.

Schiller, Dan and Shinjoung Yeo. "Powered by Google: Widening Access and Tightening Corporate Control," *The Leonardo Electronic Almanac*, 20 (2014): 44-57.

Seely Brown, John and Paul Duguid. *The Social Life Of Information*. Brighton, MA: Harvard Business School Press, 2000.

Simensky, Natassja. "Decolonialising The Archive: Morehshin Allahyari", *Sonic Acts Critical Writing*, 2016. http://sonicacts.com/critical/posts/decolonialising-the-archive-an-interview-on-additivism

Sood, Amit. "Explore Museums and Great Works of Art in the Google Art Project," *Google blog*, February 1, 2011. https://googleblog.blogspot.nl/2011/02/explore-museums-and-great-works-of-art.html.

Stubblefield, Thomas. "Iconoclasm beyond Negation: Globalization and Image Production in Mosul," *The Aggregate website*, December 12, 2016. Accessed August 15, 2017. http://we-aggregate.org/piece/iconoclasm-beyond-negation-globalization-and-image-production-in-mosul.

Voon, Claire. "Artists Covertly Scan Bust of Nefertiti and Release the Data for Free Online," *Hyperallergic*, February 19, 2016. Accessed August 15, 2017. https://hyperallergic.com/274635/artists-covertly-scan-bust-of-nefertiti-and-release-the-data-for-free-online/.

Wangkeo, Kanchana. "Monumental Challenges: The Lawfulness of Destroying Cultural Heritage during Peacetime," *Yale Journal of International Law* 28 (2003): 183-274.

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Put Evaluation into Practice: The Collaborative Residency Life Cycle

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Abstract

A residency is a conceptual space that typically sits within the physical space and networks of an organisation. The residency itself is intangible, yet exists through a structure of time, discussion, thought, action and proclamation. The residency provides space for creative practitioners to develop ideas within a supported environment, outside of their usual context. It enables immersion within different culture, exploration of practice with new people and a safe space to take risks. Practiced worldwide, the residency has become an invaluable resource for artists and the development of new work - but is its potential much greater? As producing organisations, can we work together to connect our individual residency spaces? Can we use this connection to increase value to artists and the development of art? Can we offer a more diverse cultural contribution? Can we open up our practice to new audiences? And in this unpredictable, global financial climate, can we offer greater stability by combining (often limited) resources?

These were the leading questions that we posed ourselves five years ago. What happens if we go back to these outcomes and use them as a format for evaluating existing collaborative projects and testing and setting up new collaborative residencies? In this paper we will present the background, development and outcomes of our previous experience with collaborative residencies. At the same time we will focus on what we have termed the Collaborative Residency Life Cycle, a model that can serve as a means to start thinking and developing new collaborative residencies. At ISEA2018 we aim to test the model with the audience and existing labs and individual artists/practitioners in Durban as well as the wider region of South Africa.

Keywords

Artist residency, conceptual space, transnational, collaboration, human-to-human network, trust, producing organization, shared resources, evaluation,

Introduction

In 2010, Netherlands Media Arts Institute (NIMk) led the set-up of three transnational collaborative artists in residence programmes. The first, Naked on Pluto, was collaboratively produced between Baltan Laboratories (Eindhoven, the Netherlands), NIMk (Amsterdam, the Netherlands), and Piksel (Bergen, Norway). The second, We Are Forests, was similarly produced between NIMk, 5 Days Off festival (Amsterdam, the Netherlands), Pervasive Media Studio (Bristol, United Kingdom) and Kitchen Budapest (Budapest, Hungary). During the third, two projects, Narrative Navigation and You Are The Protocol, were produced between NIMk and Vivo ARTE.MOV in São Paulo (Brasil). Each programme was unique in structure, but each worked across countries and cultures, to support research and development of new artistic ideas. Each was initiated by NIMk, but were produced and developed with mutual responsibility and equal sharing of the workload. This article sets out to share key learning from these programmes, with an aim to inform design of future schemes and reflect on the potential of the residency space. The evaluation that follows is based on these three collaborative international residencies.

What Is a Residency?

The residency should be continually re-imagined, but inherent shared characteristics within the projects that we produced were:

- Time and space for artist(s) to reside at each lab to research and develop a new work
- A modest artist fee
- Production budget (including support of travel and accommodation)
- Regularly scheduled conceptual and technical critiques with lab communities
- Online documentation of project process
- Testing opportunities
- Public presentation of research

In terms of structure, the projects were developed within different time frames, from an intense three-month period, to a number of short sprints. For each set-up, the needs of the artists, the nature of the project and the flexibility of the budget was taken into consideration. It's important to determine a clear definition of the expected outcomes of the residency. Residencies often focus on the production of a new work or commission. However, a focus on research and development can be extremely valuable. R&D frames the residency as a safe lab-style space for taking risks on new ideas. This brings a wider scope for experimentation that significantly benefits future practice and production. It

also gives rise to new forms of collaboration, creation and cooperative culture. Since completing these programmes, the project teams have discussed possible formats beyond artists, 'idea in residence'. These could include curators, researchers or producers in residence, or wider staff exchanges.

What Is the Added Value of Collaborative, Shared Residencies?

Collaborative residency programmes, particularly those that are transnational, hold increased value for both participating artists and producing organisations. For artists, shared residencies offer a context that's more than simply time and space to work. By residing at each partner organisation, time and space is multiplied across locations; and each location brings it's own culture to the work. Whether through working methods, language, conceptual interpretations or other cultural factors, a place and time can significantly influence thinking and deepen complexity of a work. For organisations, shared residencies mean shared resources. This multiplies the offer to the artist and distributes workload in terms of administration and organisation. We also found that it allows stronger relationships to form between organisations and individual producers working within them. In our experience, this encouraged valuable knowledge sharing in terms of working practices; and the formation of new transnational opportunities, collaboration and cultural capital.

Evaluation Points

When evaluating the individual projects and comparing them to each other we decided to focus on several key learning points which we defined as: 1) Focus; 2) Preparation, Planning & Duration; 3) Communication. These three areas shared common characteristics between the residencies and could also be used to bring to light more general issues.

Focus

The focus in all three residencies was very different, from working towards a presentation within a pre-set exhibition theme, to a research period, and creating an interactive project for a mobile situation. Although this difference in focus was not anticipated beforehand, it proved beneficial because it meant that different strategies could be experimented with: in terms of content, collaboration with multiple organisations in various countries, and choosing various working methods (single projects, collaborative projects).

Preparation, Planning & Duration

The structure and timing of the development period was built around the first proposals that were accepted. Nevertheless we felt with each residency that time was always too short, but it also became clear that each residence very much required its own planning and structure, because people work in different ways, have varying skills, and need various ways of guidance or assistance from the organisation, all of which can shift during the period of the residence. It is only during the process of the residency that the needs and necessities of resident artists and their project become clear. This was clearly reflected with the second case study, the project We Are Forests (a communal sound walk by Duncan Speakman and Emily Grenier). Early in the development of the residency structure, the partners had intended the outcome to be a finalised piece, exhibited during an exhibition or festival. However, as we were looking to commission an experimental work, emphasis was shifted to R&D. We still wanted to work with a festival, and the Amsterdam-based festival 5 Days Off were keen to provide support for the artists to test ideas at the festival during the development period. However, rather than using it as a platform to exhibit a final work, we all felt the creation of a lab-type space within a festival, was a much more useful and valuable approach.

The attitude of *going with the flow* is even more important in cases where people who don't know each other beforehand are asked to work together, or if the artists are in the early stages of their career and are less experienced. The latter is in some ways an advantage for the organisation, because it is easier to keep track of the working process. This is often more distanced in the case of more experienced artists who are more likely to take decisions on their own. For example, with the Naked on Pluto (a Facebook game by Dave Griffiths, Aymeric Mansoux and Marloes de Valk) residence, the planned duration of the residency was initially set to three months, but since the artists came from different countries and time planning was an issue, it was decided to extend this to a six-month residency period during which half of the time was actual working time. Furthermore, due to time and availability constraints it was decided to make a set up of 'sprints': During a period of one week the artists would visit one of the media labs and work together on the development of the project. The sprints turned out to be very productive, especially for the artists since it gave them a very intense time together to work things out.

"The sprint format really suited this project. There were parts of it that required the three of us to be together physically, to get our heads together for intense sessions of brainstorming, scriptwriting, game-world design and concept development. The sprints provided us with the time, space and focus to accomplish this. Other parts of the project required more isolation and longer stretches of individual work, such as the implementation of the interface design, writing the server and client-side code, and writing the texts for the game. Those parts were done remotely, with a bug tracker, a Wiki, and lots of video calls to sync our actions. Besides the creative and productive benefits of this format, there are also practical issues to consider. None of us could have left our home for months

on end, for example. We have families and other work obligations to consider. This way we could collaborate over a long period of time (six months), with a big distance between us (1500 km) on a project that otherwise would have been impossible to realise." Marloes de Valk[1].

The format of week-long sprints was perhaps not the most ideal for the media labs, as it gave them little time to engage with the project or with the artists since they were always extremely busy (of course) with the project. A period of at least two weeks would have been more beneficial. However, with the third case study, Narrative Navigation and You Are The Protocol, we concluded that an even longer residence period was required. In this case the cultural differences between the countries, the Netherlands and Brazil, as well as the different level of experience and expertise of the two artists necessitated a longer period of adjusting, conceptualising and developing the projects.

It was agreed by all resident artists that working between different labs and countries was extremely beneficial. The change of environment, visiting the different labs with their different backgrounds and contexts, also proved very beneficial for the artists. They liked the new environments and each one provided them with new energy and inspiration.

"What's important to me in these residencies that you've set up is that they give us more focus. The presence of a physical location and an opportunity to meet different people who are doing other things, to meet, talk, discuss and possibly exchange is very important. For example, the act of having to give presentations during the residency, which at first might seem annoying, is actually very beneficial. It forces you to explain what you're doing, to reflect on the things that have been in your head, or that have come up between the three of us, and to make some sense of it again." Dave Griffiths.[2]

Nevertheless, the spread between different countries, and different working environments, create a number of major shifts for artists. To enable artists to fully prepare and manage other work commitments, a substantial lead-in time is recommended. The intensity of the residency period and the wish to concentrate on the project during this time leaves little headspace for other projects. Being physically separate from the usual working environment was a further contributing factor. One way of dealing with this is to build breaks into the residency period. Breaks make it possible to catch up with other work commitments, and provide time for distance and reflection. If the artists do not know the labs beforehand, it would be useful to provide information and context about them in the lead-up to the residency. This could be provided by the labs/producers and by previous artists in residence, who could describe the lab environment from an artist's point of view.

Planning a return visit to the initial lab where the residency started proved also to be a good idea: a final meeting/presentation at the first lab closes the residency cycle, and gives the first lab the opportunity to experience the final results of the residency (taking into account that the initial research can be very different to the final output).

Communication

Communication and knowledge transfer inside an organisation is important, but can be less frequent than meetings with producers/artists and between producers of the different organisations. However organisational meetings with artists is recommended, as it strengthens connections, opens unforeseen exchanges and builds confidence.

Although there are cost implications, regular face-to-face meetings between all producers/labs and artists are beneficial not only to the artists, but also to the producers/labs. Face-to-face meetings allow producers to better understand the working methods of the other labs and stay more closely in touch with project development. Although process could be followed on the online project journal and blog, and tools such as Skype were utilised, we found face-to-face meetings could not be replaced. They strengthen our relationships and significantly increased opportunities for future collaboration.

Common Issues

During the evaluation process of the projects we distinguished several common issues that we believe can be generalised to other (kinds of) collaborative residences:

Trust

While it is important for the artists to understand the roles and the context of the different labs involved, it is also important for the labs to understand the working methods of the artists. Within previous (transnational) residencies it has proven an advantage if at least one of the labs are familiar with the resident artist(s). This raises questions of openness: whilst open calls create a 'way in' for artists outside of the labs networks and equally provides an opportunity for the labs to discover interesting work that was not previously on their radars, solicited applications are often a reality.

Trust between labs and the artist(s), and the labs themselves, is an essential commodity.

Collaborations are built on:

- The quality and profile of labs
- How their offer contributes to the collaboration
- How they compliment partner labs

However, the success or failure of collaboration often depends on the people within them.
Finding producers and collaborators with a can-do attitude, an open approach and an ability to learn from failure is imperative.

Documentation & Reflection

It is crucial the residency is documented throughout. Sharing process and findings as the work is developed, allows others to easily follow the project and comment where useful. Documenting the journey also facilitates valuable reflection and evaluation at the end of the residency. During We Are Forests, the artists regularly updated an online project journal that was shared on partner sites; the labs also created short videos interviews and recorded the final presentation in Bristol, http://www.dshed.net/we-are-forests. In the case of Naked on Pluto, as described above, the artists maintained a very extensive project blog that was updated regularly throughout the process and continues to be a rich source of information and reflection on the issues raised in the artwork, http://pluto.kuri.mu.

It is essential to build in moments for discussion and reflection. During each residency we organised presentations, workshops and test sessions, some of which were scheduled from the outset, some of which were ad hoc in response to the needs of the project. For example, Baltan Laboratories organised a play testing session during the Naked on Pluto sprint in Eindhoven with a group of Game Design students from the Fontys University of Applied Sciences and the Technical University Eindhoven.

"This resulted in a lot of valuable feedback on interface and game mechanics, and a mountain of new bug reports. This session was followed by several one-on-one play-tests that focused more on the individual game experience and narrative."
David Griffiths, Aymeric Mansoux and Marloes de Valk[3].

As part of We Are Forests, a final presentation took place within each residency block in each location (Bristol, Amsterdam, Budapest). The presentations were open to potential audience, other artists and those with expertise relevant to artists' practice. In Brazil, the artists were able to test different stages of "Narrative Navigation" in previously defined places where the actions could take place, considering different zones in the city with lack of digital art accessibility. Amongst the selected areas, three of them hosted Labmovel activities during the residency: public square in Freguesia do Ó, Public Library Mario de Andrade and Centro Cultural São Paulo.

As part of the third case study we conducted a thorough analysis of the impact of documentation methods that were used during the development process of the residences. For all the residences we used a blog to document the development. For Naked on Pluto a special technical blog was created which described the technical development, key decision points and the programming code that was used. One of the pitfalls of a standard blog is that the structure influences the outcome of the documentation, for example it is chronological, always showing the last post that is created. Another difficulty was setting the goal(s) of the blog: the audience you're writing for influences what you will be writing. Although all the artists were open to sharing their experiences during the process, it quickly became apparent that there are very different ways to document a process. Some artists preferred to use video statements, others captured the development in photography, some used informal and personal narrative techniques, again someone else would focus on technical steps that were made. Furthermore, the information on a blog is very contextual but the content can be accessed, copied and shared by anyone as soon as a post is published. It happened a few times that information or interviews were posted on other websites without reference or information that would explain the views expressed.

Next to an evaluation of the content and use of the blogs, with the third residence we compared the documentation strategy with documentation methods that are being developed for the restoration and preservation of contemporary art. Rather than only serving the purpose of reconstruction, these models prove to be flexible and therefore open to different usages, creating an interesting point of departure to experiment and analyse the documentation of artistic working processes. The main focus of these models is doing interviews with the artists during the whole process at set times and around specific issues. The documentation models proved to be valuable guides for posing questions and addressing specific issues. The interviews clearly showed the changes in the artists' thinking and their decision-making processes. A more in-depth analysis could provide other artists, developers, researchers and organisers with interesting insights and useful information regarding creative and artistic working processes.

Ongoing Questions

Should the role of the labs be defined within the residency? In both cases, the role of 'facilitating making and thinking' was present at each location. However each lab had a unique emphasis, drawn from the expertise within their communities. It's therefore important to define not necessarily the role of the labs, but the specialist qualities of each lab and what their communities offer. This enables artists to efficiently plan and maximise project development at each location.

- How can we best keep each other updated about process and facilitate communication between labs? We have continuing discussions on this point. Online tools were utilised frequently throughout the residency, but as previously mentioned, the importance of face-to-face meetings should not be underestimated.

- Is there a necessity to match-make and support networking of artists? This is important and as individual labs we often provide this 'service' within our constituencies. However, there is a

great opportunity to escalate this by facilitating cross-lab networking.

Key Findings: The Collaborative Residency Life Cycle

The life cycle of a collaborative residency begins before commencing the development period and continues for a short while afterwards. From the experience of producing the different projects, we recommend considering the following:

Before

- Build the collaboration: identify partners with complimentary values yet unique offers, who advocate open, collaborative approaches;
- Consider western and non-western ways of working and producing residencies;
- Research phase: Select an artist who also advocates an open, collaborative approach. Engage in subsequent discussions regarding the project and possible needs and begin sourcing collaborators etc.;
- Manage expectations: it's important to get this right from the outset and get it right with everyone involved, including artists, labs, partners, collaborators etc.;
- Define the scope, resources, goals and identify the adjustable variables;
- Identify the opportunities to work with and learn from partner organisations and where possible, build these opportunities into the programme from the outset;
- Is the residency an exchange or not? Ensure everyone has a shared understanding and attitude.

During

- Encourage curiosity through regular critiques and (in terms of technology augmented projects) testing of the work;
- Maximise the relation to local context;
- Residencies contribute to making the lab into what it is - consider how to keep traces of that and share it;
- Be aware of the everyday life dimension of the residency - the human, informal dimension - it's essential;
- Flexibility can be an issue, find a cohesive way to accommodate it;
- Get deep into other partners ways of working;
- Document and share the process throughout.

Afterwards

- When does the residency end? Bring it to a celebratory close;
- Disseminate the 'story' (public and other) and present work-in-progress;
- Share key learning;
- Consider how to continue fostering relationships between host and artists; and between project partners. Also consider how to continue the exchange of knowledge;
- Consider how to measure the outcome qualitatively and quantitatively;
- Consider how to support the work beyond the residency period: is there scope for touring? Or informal advice you can offer on opportunities such as project grants, or other residencies the artists could access, to further develop the work.

The potential impact of the transnational collaborative residency is great. It makes space for ideas and reflections that would not otherwise be possible. It creates focus, accelerates project development and exposes process. As producing organisations, we've found that we *can* work together to connect place and space, link our networks, and share resources and knowledge. Through this cooperation, we *have* multiplied support for artists, offered diverse cultural contributions, archived process and increased our engagement with audiences worldwide. And in the present, unpredictable, global financial climate, we believe this model *does* offer increased stability for artists and participating organisations, and unlocks potential that we simply hadn't imagined when we began.

Conclusion & Open Call

In this paper we propose a practical approach for collaborative artists-in-residence formats based on shared interests and exchange between different organisations. Our approach was based inside existing cultural lab settings in which people and their local knowledge and expertise were key decisive factors for the development process of the project. Such a practice largely depends on human-to-human networks that can sustain and bring into view alternative possibilities. Our aim with this open call is to further expand and test this model in different settings. Having experience in different countries and regions, from large metropoles such as Sao Paolo (Brasil), to small towns such as Bergen (Norway), and vibrant capitals such as Amsterdam (the Netherlands) and Budapest (Hungary), we believe that er can scale collaborative artist-in-residence to various needs and possibilities. We will follow up our paper presentation with an informal gathering where we will actively invite local communities and independent artists/practitioners to evaluate local cultural case studies and discuss potential collaborations. Before and while being in Durban we will connect with organizations such as Art Space Durban, The Maker Space and others. We are particularly interested in exchanging ideas about formats of collaboration and the value and challenges that derives from them.

Acknowledgements

We would like to acknowledge the involvement and support from the previous individuals who collaborated on the outcomes of parts of this paper, in alphabetical order:

Lucas Bambozzi, Gisela Domschke, Emilie Grenier, Dave Griffiths, Gisle Froland, Jan Hiddink, Aymeric Mansoux, Elisabeth Nesheim, Angela Plohman, Clare Reddington, Melinda Sippos, Duncan Speakman, Victoria Tillotson, Marloes de Valk, Sander Veenhof.

References

[1] Marloes de Valk in "Interview with Dave Griffiths, Aymeric Mansoux and Marloes de Valk", *A Blueprint for a Lab of the Future*, Baltan Laboratories, 2011.

[2] Dave Griffiths in "Interview with Dave Griffiths, Aymeric Mansoux and Marloes de Valk", *A Blueprint for a Lab of the Future*, Baltan Laboratories, 2011.

[3] "Naked on Pluto" in *A Blueprint for a Lab of the Future*. Baltan Laboratories, 2011.

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The Serendipitous Pattern in Interaction Design

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Abstract

Serendipity is increasingly becoming a concern in the design of interactive systems as an alternative to the echo chamber effects being felt in the medium. However, the concept of serendipity is one shrouded in ambiguity, which limits our abilities to regard it as an achievable goal in interaction design. Based upon literature review, as well as empirical research, we propose a Serendipitous Pattern that identifies the core moments of serendipity, as well as the role of the human agent. Through this pattern, we are able to lay the groundwork for establishing a framework that enables the design of serendipitous systems.

Keywords

Serendipity, Information, Discovery, Interaction Design, Digital Medium.

Introduction

Serendipity, according to Walpole who coined the term in 1754 (Merton and Barber 2006, 1), is the result of accidental discovery and human sagacity. Considering the contemporary world and its richness and variety of information, there is a growing need to design systems that encourage serendipitous discoveries, especially those that are able to counter the growing signs of the balkanisation (Van Alstyne & Brynjolfsson, 1996) resulting from the catering of information and creation of echo chambers and feedback loops (Pariser, 2011). Through designing for valuable unpredictability—serendipity—we are able to introduce divergence experiences into our daily interactions within the digital medium. However, in order to be able to design systems that enable serendipity discoveries, we need to identify the distinct moments that constitute the serendipitous experience.

A Model for Serendipity

Acknowledging serendipity's relationship with information discovery, we began our approach by establishing a serendipity model by looking into information behaviour literature for theoretical constructs and models that could be applied to the experience of serendipity, such as with T.D. Wilson's information-seeking model.

Figure 1. Model for Information-Seeking Behaviour ©T.D. Wilson 1995

T.D. Wilson's model suggests four distinct methods that describe information-seeking behaviour: *Passive attention*, *passive search*, *active search*, and *ongoing search*. Of these, one may argue that the moment that begins the serendipitous process occurs during a process of passive attention. However, this would ignore the cases in which the discovery that triggers serendipity occurs in moments where there is no attention of search being paid, passive or otherwise.

As such, traditional representations of information-seeking behaviour do not apply in the case of serendipity, as serendipity does not begin with human intention (a conscious act as a response to an identified need), even if the position towards information seeking is a passive one, as Wilson's model foresees. Serendipity is the result of a change in the world—an unexpected encounter, henceforth described as *trigger*—that begets the serendipist[1] attention. Information seeking models do not contemplate this trigger.

[1] The one that experiences serendipity.

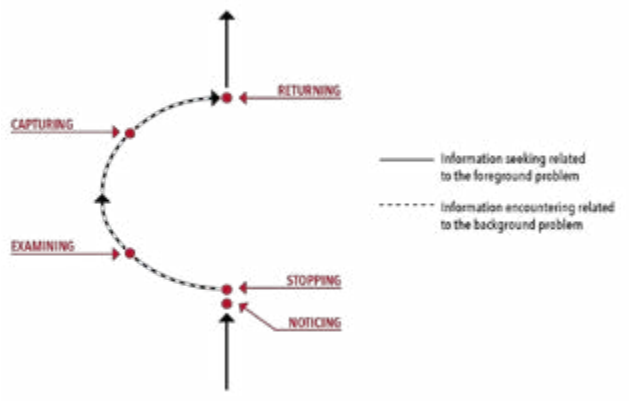

Figure 2. Graphical representation of an event of information encountering within an activity of information seeking © S. Erdelez 2004

Within the subject of information, Erdelez (2004) model of information encountering captures the noticing aspect of serendipity, however it ignores the potential of the human actor, as well as the unpredictability aspect, focusing instead around the concept of finding something while looking for something else, or when engaged on a different activity.

Erdelez's model, while relevant, does not represent the entirety of serendipity as we believe it. Lawley and Tompkins's model (2008), on the other hand, is more encompassing and representative of serendipity, as well as identifying a necessary pre-stage: *Prepared Mind*.

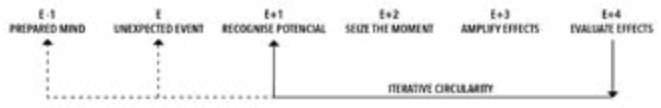

Figure 3. Lawley and Tompkins' perceptual model of serendipity © Lawley and Tompkins 2008

E-1: Prepared Mind is followed by an act of noticing by the observer, such as with Erdelez's model for information encountering. However, in Lawley and Tompkins this act of noticing is explicitly the result of an "unexpected event". These are followed by a moment of *Recognise Potential*, in which there is a "forward-facing" evaluation of the event, recognising a serendipitous potential. This is followed by an event to *Seize the Moment*, in which there is an action to "to preserve and amplify the potential", followed by a possible a moment of *Amplify Effects* wherein other events can occur to "turn an event from an interesting anomaly into serendipity", finally followed by a final moment of *Evaluate Effects*, in which there is a "backward-facing" reflection upon the events, adding to it judgement and evaluating the possible effects that resulted from the event on the one experiencing it.

Lawley and Tompkins's model (2008) shares common ground with Rubin et al.'s four facets of serendipity (Rubin, Burkell, & Quan Haase, 2011): *Prepared Mind, Act of Noticing, Chance*, and *Fortuitous Outcome*, identified in their study of serendipity in everyday encounters accounted in personal blogs.

Facet A: Prepared Mind builds upon Walpole's original concept of sagacity and reflects Lawley and Tompkins's E-1. According to Rubin et al., prepared mind is the result of a prior concern—"a pre-existing problem"—that is linked with a previous experience—"a personal accumulated knowledge or expertise"—that shed light towards a particular find, defining its importance, as well as influence the actual act of noticing "making it more likely that some types of finds (those related to prior concerns) will be noticed." (2011)

Facet B: Act of Noticing describes a need "to be able to notice the find and shift the attention from a primary activity to a clue in the environment". Rubin et al. cites Erdelez's term of "trigger" as an example of this act of noticing.

The act of noticing is followed by *Facet C: Chance*, a "necessary pre-condition of serendipity" that "captures the accidental nature of the encounter and underlines the perceived lack of control" (Rubin et al., 2011).

While Rubin et al. utilise the term "chance" to describe the third facet, they define it as both possibly accidental as well as unplanned and is characterised as the perception of lack of control. The key issue here is that the experience was not motivated by the one experiencing it but comes unexpectedly. It mirrors Laweley and Tompkin's "unexpected event".

Lastly, *Facet D: The Fortuitous Outcome* describes the necessity of the "chance encounter" to provide "unexpected benefits linked to the find", wherein the experience of serendipity is framed as a valuable experience with tangible, beneficial, results. This mirrors Lawley and Tompkins *Recognised Potential* that is the result of an evaluation of the effects.

Building upon both Rubin as well as Lawley and Tompkins models, Makri and Blandford empirically-grounded process model of serendipity chooses to focus not on events but on the mental *connections* (2012).

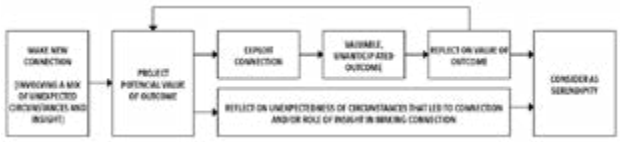

Figure 4. Makri and Blandford's empirically-grounded process model of serendipity © Makri and Blandford 2012

Makri and Blandford's (2012) model reinforces that serendipity is the result of a reflection on the perceived value of the outcome that begins with "making a new connection". It is the result of 28 semi-structured interviews to graduate students and research and academic staff as previous studies "had suggested that serendipity is often an important part of research". While Makri and Blandford's model is of particular interest to the mental processes of deriving insight from unexpected connections in the process of research (what we define as "Serendipity as Knowledge"), it largely ignores other possible serendipitous outcomes (values) of serendipity, such as Experience and Creativity.

As this research is encompassed within the subject of interaction research, we attempted to situate the serendipitous moment within interaction itself. Don Norman's action cycle is well suited for this since, as he himself explains, it can be motivated not only by the establishment of a new goal, but also from an event that triggered it, which Normal refers to as "data-driver or event-driven behaviour" (Norman 2013, p. 43).

As such, the interaction action cycle is able to accommodate the encounters and unexpected events previously identified. This occurs following a change in the world (trigger), starting the *Bridge of Evaluation*, which consists by first a moment of perceiving (which corresponds with Erdelez's moment of noticing), followed by a moment of interpretation (Lawley and Tompkins's recognise potential) that leads to a moment of comparison, whereas there is a reflection on the possible value (comparing the change in the world with an underlying necessity). If, following a reflection of value, that value is recognised, there is a moment of epiphany that generates said value.

However, in the case of serendipity, not every change in the world requires a completion of the action cycle, as the moment of serendipity exists before the possible formation of a goal. In the cases that the moment of serendipity begets further action, Norman's action cycle is completed, if not, there is a moment of capture (Erdelez, 2004), followed by returning.[2]

As such, building upon previous models, as well as Norman's action cycle for interaction, we identify three specific stages that are key for the definition of serendipity.

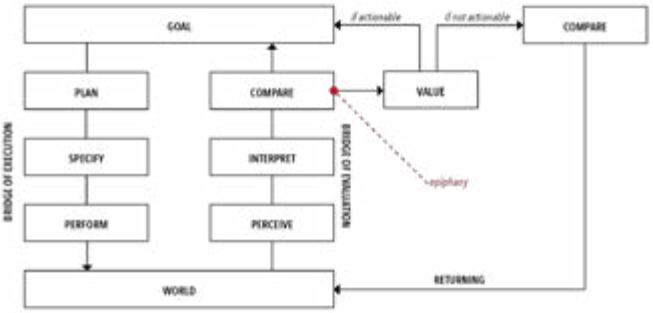

Figure 5. Norman's action cycle with our three stages of the serendipitous pattern.

These stages are common both within Merton's pattern as well as following models of serendipity. We can consider them core stages of serendipity. Here we refer to them as *trigger*, *epiphany*, and *value*.

The observer notices an event that acts as trigger (by connecting that event with some previously established data), leading to a moment of epiphany and the creation of value.

[2] As it relates to "serendipitous" web browsing, De Bruin and Spence identify a third possibility: forgetting, which occurs if there is moment of recognised serendipitous value as well as no immediate action (De Bruijn and Spence).

These stages do not replace other models, but encompass them and encircle them within Norman's cycle, identifying key moments that are relevant for the development of serendipitous systems.

A Serendipitous Pattern

Stage 0: Prepared Mind

Preceding any experience of serendipity, and as we've seen in Lawley and Tompkins (2008), Rubin et al. (2011), Makri and Blandford (2012), as well as in Walpole's original definition, there is a stage (to which we refer to as *Stage 0: Prepared Mind*[3]) that concerns the human actor that experiences the serendipitous pattern and describes the required openness in order to allow for the serendipitous pattern to occur.

This pre-required stage of the serendipitous pattern correlates to E-1 of Lawley and Tompkins's model: "a mind that is prepared to recognise unexpected potential and then seize the moment", encompassing both prior study as well as knowing one's self-bias.

There is an argument to be made regarding the necessity of a mind-set that can be cultivated and incentivised, in order to encourage serendipitous experiences, as Rosenman (1988, p. 137 in Foster and Ford, 2003): "By realising that discovery involves a dynamic interplay between conventional scientific methods and chance in all of its forms, and by cultivating an aptitude for serendipity, scientists can greatly enhance their investigative powers". This argument puts forward the notion that serendipity is less the outcome of chance and more of what the serendipist brings to the experience.

The idea that there is precondition that influences the experience of serendipity is corroborated by Makri and Blandford, that suggest that "being open to new connections could be influenced by their mood and by exposing themselves to new situations and experiences — particularly those outside their confort zones" (2012)

Likewise, this notion was reflected on our own studies, through the observations and exercises realised with first-year design students, wherein those that were receptive to the concepts related to serendipitous discoveries produced the richest results. (REDACTED)

Stage 1: Trigger

The first stage of the serendipitous pattern starts with a moment of noticing a trigger (Erdelez 2004; McCay-Peet and Toms 2010). This act of noticing can be the result of a casual observation done by the human actor, or by an action done by a system that demanded her attention.

[3] The term "prepared mind" is based on both Lawley and Tompkins and Rubin et al.'s utilisation of the expression, which in turn reckons back to Louis Pasteur famous aphorism "Dans les champs de l'observation le hasard ne favorise que les esprits préparés".

This stage corresponds to Lawley and Tompkins's *Unexpected Event* as well as both facets B and C of Rubin's facets of serendipity, although sequential and reversed (first there is a moment of chance/accident/event that occurs outside human control (facet C), followed by a moment of observation and attention (facet B). These two moments are interlinked and cannot be disassociated. An unobserved event is an irrelevant event (therefore it cannot act as a trigger) and a without an unexpected event, there is no observation to be made.

Van Andel and Bourcier (1997, in Campos and Figueiredo, 2002) offer a distinction between triggers that are a result of an external event, and those that are the result of some sort of mental activity, classifying them in two sets: ad oculus stimuli (produced externally, mostly in tangible means); and "mental" stimuli (proceeding from some sort of mental activity) (Campos and Figueiredo 2002).

As observed in Stage 0, every serendipitous pattern requires a mental, internalised process that leads to a 'aha' moment. However internal triggers are those that do not require any external event to kickstart the mental processes that lead to the moment of insight. It is not within our objectives to explore the possibilities to *design* the necessary mental processes that could lead to an internal trigger,[4] as opposed to external triggers.

Makri and Blandford (2012) propose that triggers can be based on a memory, being that it is not absolutely necessary to experience the trigger in real time for serendipity to occur. While apparently similar these differ from internal triggers in the sense as these are remembered external triggers. The triggers can be well-defined or vague, through *things*, such as a "person", an "event", a "place", "information" or an "(non-informational) object".

Building upon Makri and Blandford collection of *things* that address an explicit or implicit necessity that the serendipitous experience address, we've identified three broader categories of external triggers—*Things*, *Places*, *Events*, and *Agents*—that encompass Makri and Blandford's examples along with others that were identified in our research.

Things

Our usage of the term *things* differs from Makri and Blandford (2012) as we do not contemplate persons, places or events in it. Instead, we consider things as inanimate material objects, natural or artificial (when artificial, we shall refer to things as artefacts). *Things* can, likewise, be both physical or digital (it also follows that all digital things are artefacts, hereby mentioned as digital artefacts when necessary), and need to be perceptible in some fashion in order to act as triggers. A notification on a smartphone, a book, an informative flyer, a rock, a pop-up window, both a song or a single note on a piano, all of these are things.

While Makri and Blandford distinguish between informational and non-informational objects, we adopt Buckland's approach of information as *things* (1991), although we prefer the term *meaning* instead of information to differentiate from things that are designed to communicate and those that aren't but aren't.[5]

As such, anything can have implicit or projected meaning. Things with implicit meaning are those with encoded information, such as data and documents (Buckland, 1991). Things with projected meaning are those that, nevertheless, communicate and are meaningful to the observer, but their meaning is projected upon the thing by the person noticing and experiencing it, based on the person's thoughts, experiences, and feelings.

Take, for instance, a paper-clip found in a pocket while grocery shopping. This paper-clip could act as a trigger, remembering the shopper to buy office supplies as well. Or a cold gush of wind when stepping outside, remembering the person to wear a jacket. There is no implicit meaning on this thing but, nonetheless, they communicate.

As such, anything can communicate meaning and, as such, act as a trigger in the serendipitous pattern.

Places

Triggers can occur as the result of specific places. These can be physical (towns, streets, buildings, as in (Makri and Blandford's own examples), as well as virtual (websites, software, virtual reality), or the combination of both (such as augmented reality or location-aware software). The key component of these triggers is the interaction between who experiences serendipity and the space where it happens.

The design of physical spaces in order to encourage serendipity can be described as what Cooper describes as *environmental serendipity* (Cooper 2014, 421)

In the case of *places*, serendipity is not triggered by interaction with a particular *thing*, as in the previous example, but through the interaction where these things are encountered. The classical example is an unexpected book being discovered while browsing through a bookcase in a library. The trigger here is not the book (which would be a *thing*), but the library itself (a place).

These spaces can be traversed three-dimensionally, as in the aforementioned example or in a virtual environment (such as in a 3D video game). It may also occur in 2D environments that are able to be such as a website, but also the pages of a particular book, as long as the navigation and interaction are non-linear.

[4] Beyond the identification of the particular qualities that encourage serendipitous experiences, such as was introduced in Stage 0, qualities that can, nonetheless, be actively developed. These internal factors, however, differ from those described by van Andel and Bourcier that can lead to an internal trigger. While there is an argument to be made that practices such as psychoanalysis could have a visible impact on encouraging internal triggers, they lie outside the scope of this research.

[5] As it relates to this research, and to avoid ambiguity, we adopt Raya Fidel's definition of information as "a strung of symbols that 1. Has meaning, 2. Is Communicated, 3. Has an effect, and 4. Is used for decision making." (Fidel, 2012, p.6)

Both Björneborn (2017) and Dörk et al. (2011) consider the concept of explorability a "key guiding principle for design of urban or digital environments" (Björneborn, 2017) that may trigger serendipitous experiences, encouraging "information flâneurs" (Dörk, 2011).

Taking inspiration of the artistic urban movement of psychogeography and the *dérive*, the intention is to enable an exploration of space that encourages the stumbling and unexpected encountering of information.

Besides *explorability* Björneborn (2017) identifies as well *sensoriability*, *traversability*, and *diversifiability* as key components that enable serendipity to be triggered in physical spaces. However, he argues that while *sensoriability* is rich in physical spaces, the same is not true in digital ones where "typically only sight and hearing are activated" (2017). On the other hand, *traversability* may be richer in digital environments, where mobility is not encumbered by the limitations that exist in physical spaces for the "transportation of people and resources". Finally, Björneborn suggests equal level of *diversifiability* both in physical and digital spaces.

Lastly, *places* can trigger serendipity through the experience of an *aporia* (Aarseth, 1997, p. 3)—where the environment (or *place*) itself is designed in order to prevent the reader[6] to make sense of the whole. The moment that there is a realisation—an insight—that allows the reader a "link out" (Aarseth, 1997, p. 91) that permits the reader to understand the whole of the place, an epiphany replaces the aporia.

Events

Events, as suggested by Makri and Blandford (2012), can be triggers for the serendipitous pattern (as well as information themselves (Buckland 1991)). These are happenings that exist at a particular time and may, or may not, exist at a specific place.

While the examples Makri and Blandford offer for events relate to a particular place (conferences, meetings, and parties (2012)), this is not a requirement. In fact, and more-so with modern communication technologies, events can be decentralised, defined only by a particular time.

Consider, for example, a memory triggered by the fact that it is nightfall. The defining factor of the event is the sunset itself, not where the sunset is experienced.

Events can be experienced on an individual level (as the aforementioned example) or collectively, where something occurs at different places and spaces but are characterised by a common time and action (as, for example, Earth Hour, where lights are turned off during an hour at various different places). Naturally, serendipity only occurs individually, but the trigger that begets it can be the result of a collective event.

Agents

We we've also identified other agents (such as human beings) as possible triggers for the serendipitous pattern, through interaction with said agents (through, for example, communication, which "is instrumental to accidental discovery" (Race and Makri 2016, 20)).

Here we choose the term *agents* in order to represent actors besides the one that experiences serendipity (the serendipist actor) but actors that have, nonetheless, agency as defined by Murray (2012). This means that agents are actors that can "initiate behaviors autonomously" (Murray 2012, 410) and whose behaviour is, in practicality, unpredictable to the human actor.

For the sake of simplicity, when referring to agents we shall refer mainly to human agents or those that are equally complex (such as a hypothetical advanced AI), while other non-human agents shall be understood as things.

In this sense, agents are *undesignable* triggers. However, we are able to design *things, places*, and *events* that act as a medium between agents and encourage interaction. These could be done through encouraging awareness between agents (Jeffrey 2000), mediating intimacy (Gibbs 2005) collaborating creatively (Bryan-Kinns 2004), or through the design of a building, such as the example of the design of the Pixar building, that shared a common entrance where common facilities which "resulted in cross-traffic—people encountered each other all day long, inadvertently, which meant a better flow of communication and increased the possibility of chance encounters (Catmull and Wallace 2014, 365)

Here, there is a thin line that separates serendipity through interaction with places or with other agents: if the serendipitous experience ends with the discovery of another agent in a particular space, the trigger is the space, while if the serendipitous pattern is the result of the interaction with said agent, the trigger was a pattern. In both cases, the space can be a designed medium to facilitate serendipity.

Stage 2: Epiphany

Following the trigger that sets the serendipitous pattern and emotion, and the sub-sequent act of noticing, interpreting, and comparing (described in Norman's "Gulf of Evaluation" (Norman 2013, p. 39)) where the investigator is stimulated to "make sense of the datum" (Merton, 1968, p. 158) the second stage of the serendipitous pattern corresponds to the moment in which the connection is made between the serendipist need and the trigger event observed.

This stage, here called epiphany, is where there is a recognised potential from the trigger (corresponding to Lawley and Tomkins' "E+1: Recognise Potential"). At that moment there is a "projection" of the "potential value of the outcome" (Makri and Blandford 2012).

While the term conjures images of a heavenly light shining around Saul on the road to Damascus, this creative moment is not a gift from the gods but the moment where the subconscious work of incubation bursts into the surface of consciousness.

This moment is described by Boden as a flash of insight, according to Poincaré's four phases of creativity (named by Hadamard as *preparation*, *incubation*, *illumination*, and

[6] In the particular case of hypertext.

verification), in which there is an unexpected moment of creativity following a phase of subconscious incubation (Boden 2004).

Next comes the flash of insight, to which— despite its unexpectedness as a conscious experience—Poincaré ascribed a significant mental history: "sudden illumination [is] a manifest sign of long, unconscious prior work" (Boden 2004, 30).

Epiphanies, minor or larger, are prevalent throughout all human experience, and not all epiphanies are the result of an unpredicted external trigger, thus not all epiphanies are the result of serendipity. However, all experiences of serendipity do require a moment of epiphany.

Just as Archimedes' famed proclamation following the observation of the water level on the bath, epiphany is the result of what McCay-Peet and Toms (2010), citing Koestler, refer to as a bisociation (a surprising association between disparate, previously unconnected pieces of information), or what Makri and Blandford (2012) refer to as a connection.

As it is the result of a mental process, it is difficult to describe (Makri and Blandford 2012). It can answer an underlying query or need, such as Makri and Blandford's example of "to find love", but as they demonstrate in the example of one of the interviewees realising that he needed a bicycle the moment his neighbour gave him one, the need being addressed by the serendipitous moment is only realised "at the time the connection is made" (2012).

Stage 3: Value

To be considered as serendipity, the epiphany that results from the process must be valuable to the human actor.

Your discovery may well be interesting and informative, but it will not be truly serendipitous unless it helps you fill in a piece of a puzzle you've been poring over (Johnson 2010, 109).

As such, the final stage of the serendipity process is the identification of value from the experience. This value is a key element of serendipity what distinguishes it from coincidence (Bogers & Björneborn, 2013).

Corresponding to Lawley and Tompkins E+4 moment of serendipity "Evaluate Effects", as well as Facet D of Rubin: "Fortuitous Outcome—in which there is a perceived gain/happy ending—value is recognised looking backwards to the experience and reflecting upon it. According to Cunha's definition of serendipity (2010, 320) as "the accidental discovery of something that, post hoc, turns out to be valuable", value is only considered upon reflection (immediately following the moment or afterwards in, what Rubin et al. call's a "reframing of events (2011).

Although already considered valuable to some extent, the full extent of the value of the outcome becomes apparent over time – through an iterative process of projecting further value to be gained from the connection, continuing to exploit the connection and *reflecting on the value of the outcome.*

After reflecting on both the value of the outcome and the involvement of unexpectedness/insight, the experience can be considered as serendipity (Makri and Blandford 2012).

Also, as observed by Makri and Blandford, future events can increase or decrease the perceived value of the serendipitous experiences (what Lawley and Tompkins refer to as an "Amplification of Effects"), based on following subjective experiences and the relative impact of that value had in the subject's life. Although the long-lasting impact of the value derived by the serendipitous experience can only express itself over time, there is still a necessity, at the moment of the serendipitous experience, to recognise a certain value and, if necessary, act upon it (completing Norman's action cycle) or, if no further action is required (no goal is established), then there is a moment of capturing (as per Erdelez's model of Information Encountering) and a return to the World.

The value of serendipity, however, can manifest itself in different fashions, each of it with different implications on the experience. We have identified three ways in which serendipitous value can be expressed: through the acquisitions of knowledge, through experience, and through a creative act.[7]

Serendipity as Knowledge

Perhaps the most researched aspect of serendipity, and the most commonly associated with the term itself, is the creation and production of new knowledge as a consequence of the serendipitous experience. A new insight that follows a connection with information (Makri and Blandford 2012) regarding an underlying question or necessity, commonly illustrated by the examples of Archimedes or Alexander Fleming in which an unexpected (and unpredicted) event triggers a deduction.

This may be the result of new (relevant) information, as well as previously known information that it is presented at an opportune time.

Described by Fine and Deegan as "analytical", this manifestation of serendipitous value "involves the ability to establish connections between data and theory (1996).

It is the assumption in Merton's pattern of serendipity, where the insight that is generated "stimulates the investigator" to "fit it into a broader frame of knowledge" (1968, pp. 158–159), which leads to an abduction and the production of knowledge.

In order for knowledge to be created, in the context of qualitative research, Fine and Deegan identify a series of possible processes that allow for an insight to occur: The first is a previous exposure to previous knowledge (such as relevant literature on the matter) allowing for one to see

[7] These correlate, to some extent, with Fine and Deegan's three potential opportunities that "chance provides": temporal serendipity, serendipity relations, and analytic serendipity" (Fine and Deegan). While Deegan's serendipitous opportunities are in regard to qualitative research, those identified here are in regards to interaction design. Nonetheless, the possible correlations between shall be appropriately identified.

"relevance where none was noticed before", perhaps as the result of interdisciplinary interests and influences. Secondly, the data needs to "speak to the researcher". Thirdly, the problem needs to be conceptualised in a novel form that reframes the problem (as, perhaps, a dramatic metaphor or narrative strategy); Finally, the researcher "may be influenced by being part of a scholarly world", in the sense that the social ties that connect researchers can influence the work being developed.

By knowledge, however, we do not necessarily mean historically and scientifically significant knowledge that is required to be produced. It can be pedestrian, such as Raya Fidel's example for information encountering: "Finding a telephone number one will need tomorrow while surfing the web, or happening upon a nice toy store when going to a new movie theater, after unsuccessfully searching for a toy shop, or finding information when reading for pleasure." (Fidel 2012). This is knowledge, even if only individually significant.

Serendipity as Experience

Serendipitous value can be found not only through the discovery of new and meaningful knowledge, but also through an unexpected and meaningful experience, where one does not necessarily discover a particular bit of information that may or may not produce insight, but where one finds oneself the subject of a particular experience with unexpected and unsought results. Research in serendipity as experience has been developed as it relates to listening digital music (Levy, 2006), as well as when interacting with personal media collections (Bentley et al., 2006; Helmes et al., 2011).

One example of how serendipity can be a valuable user experience is Leong, Vetere, and Howard's empirical studies with random-led listening to digital music (2008). Leong's argument is that the necessity of having to choose what to listen to within a large musical library can be "unpleasant and even paralysing", particularly when the user doesn't have a particular preference. As such, abdicating of their ability to choose what to listen to, can lead to an enriched listening experience and even encourage "encounters with serendipity".

Their findings reported that "the surrender to a random process coloured participants' listening experience with unpredictability". By experiencing music through this shuffle functionality, individual listener perception was increased for not only each track but also of for those that preceded and followed, creating the necessary conditions for "intense experiences such as serendipity". Some examples of these experiences of serendipity could be observed with the listener having a desired track start to play randomly, at the right moment; when a track meaningfully resonates with a particular sentiment the listener was experiencing or simply as a freak coincidence (Leong et al., 2008).

As Leong et al. conclude, there is a great deal of value to be discovered if we explore alternative methods of interaction (random and abdicating choice in this particular example), that are capable of creating meaningful experiences.

Serendipity as Experience accommodates, as well, the "temporal" and "relations" examples of serendipity described by Fine and Deegan (1996).

"Temporal serendipity" refers to "being exposed to a particularly dramatic event can, at times, transform a mundane ethnography into a classic", where who experiences serendipity will recognise it "as significant when they occur and will be shaped into powerful narratives", while by "serendipity relations", Fine and Deegan refer to the establishment of personal connections through acts of "good fortune" that still require the ability of the serendipist to "capitalize on this contact" (1996), leading to serendipity.

In both cases, there is the experienced value, while there isn't, necessarily, identifiable knowledge or creation that resulted from the serendipitous moment. Regardless, this value should not be ignored from the development of serendipitous systems.

Serendipity as Creativity

Serendipity is intrinsically connected with creativity. To experience serendipity is to experience a moment of creativity that results from a moment of unpredictability. As with creativity, while one cannot systematically provoke serendipitous moments, we can create the necessary conditions that have proved to be conducive to serendipity.

Boden's own definition of creativity—"the ability to come up with ideas or artefacts that are new, surprising and valuable" (2004, p. 1)—is reminiscent of many definitions of serendipity. In fact, we may even consider that, while not every creative moment is necessarily serendipitous, all serendipitous moments are creative ones.

To experience serendipity is to experience what Boden defines as psychological (or personal) creativity, as in, a personal discovery. That is not to say that it cannot lead to a historical, or absolute-creativity, as the eventual outcome (in fact, the history of inventions and creativity are filled with anecdotes of such events), but the process is circumscribed to a P-creative one.

Value in serendipity is found in creative outcome, but the act of serendipity is, in itself, a moment of combinatorial creativity, as it is the result of a connection, done unconsciously and after a particular input or signal that triggers that moment. When describing creative value in a serendipitous finding, we are referring to the utilisation—and expectation—of serendipity within the creative process, deployed knowingly and purposefully.

This particular intentionally can be observed in Philip Galanter's definition for generative art, in which artists use systems with a certain degree of autonomy to create a work of art (2003). Through the use of autonomous or semi-autonomous systems (such as, for example, an algorithm), the artist knowingly expects to be serendipitously surprised by a particular result.

Systems and creative tools could be designed in order to further explore accidents in the creative process in order to

turn them into serendipitous moments, as Boden suggests: "If knowledgeable agents were developed to help us make the best of our mistakes (not just avoid them), they could lead to some real surprises" (2010, p. 171).

Conclusion and Future work

In order to be able to design interactive systems that afford serendipitous experiences, we must first understand the specificities of the experience of serendipity itself.

Based upon a review of the literature, we established a model for serendipity within Norman's Action Cycle, establishing a based within interaction design for the experience of serendipity, followed by an exploration of the three core stages necessary for serendipity to be experienced—*Trigger*, *Epiphany*, and *Value*—as well as a necessary required stage—*Prepared Mind*—regarding the human component in recognising serendipity.

In future work we expect to continue to explore the intrinsic qualities of serendipity—particularly the role of chance in it—, as well how it can be encouraged through design.

Acknowledgements

This work is financed by FCT — Fundação para a Ciência e a Tecnologia — as part of the PhD Programme in Design «PD/00048».

This work is financed by the ERDF – European Regional Development Fund through the Operational Programme for Competitiveness and Internationalisation – COMPETE 2020 Programme within project "POCI-01-0145-FEDER-006961", and by National Funds through the FCT – Fundação para a Ciência e a Tecnologia (Portuguese Foundation for Science and Technology) as part of project "UID/EEA/50014/2013".

References

Aarseth, E. J. (1997). *Cybertext: perspectives on ergodic literature*. Baltimore, Maryland: Johns Hopkins University Press.

Bentley, F., Metcalf, C., & Harboe, G. (2006). *Personal vs commercial content: the similarities between consumer use of photos and music.* In Proc of CHI, 667-676.

Björneborn, L. (2017). Three key affordances for serendipity. *Journal of Documentation*, *73*(5), 1053–1081.

Boden, M. A. (2004). *The Creative Mind: Myths and Mechanisms*. Psychology Press.

Bogers, T., & Björneborn, L. (2013). Micro-serendipity: Meaningful Coincidences in Everyday Life Shared on Twitter. *iConference*, 196–208.

Buckland, M. K. (1991). Information as thing. *Journal of the American Society for Information Science*, *42*(5), 351–360.

Campos, J., & Figueiredo, A. (2002). Programming for Serendipity. *SSRN Electronic Journal*.

Catmull, E., & Wallace, A. (2014). Creativity, Inc. Random House.

Cooper, A., Reimann, R., Cronin, D., & Noessel, C. (2014). About Face. John Wiley & Sons.

Dörk, M., Carpendale, S. and Williamson, C. (2011), The information flaneur: A fresh look at information seeking, in *Proceedings of CHI 2011*, pp. 1215-1224.

Erdelez, S. (2004). Investigation of information encountering in the controlled research environment. *Information Processing & Management*, *40*(6), 1013–1025.

Fidel, R. (2012). Human Information Interaction: An Ecological Approach to Information Behavior. MIT Press.

Fine, G. A., & Deegan, J. G. (1996). Three principles of serendip: insight, chance, and discovery in qualitative research. *International Journal of Qualitative Studies in Education*, *9*(4), 434–447.

Foster, A., & Ford, N. (2003). Serendipity and information seeking: an empirical study. *Journal of Documentation*, *59*(3), 321–340.

Galanter, P. (2003). What is generative art? Complexity theory as a context for art theory.

Helmes, J., O'Hara, K., Vilar, N., & Taylor, A. (2011). Meerkat and Tuba: Design Alternatives for Randomness, Surprise and Serendipity in Reminiscing. In P. Campos, N. Graham, J. Jorge, N. Nunes, P. Palanque, & M. Winckler (Eds.), *Human-Computer Interaction – INTERACT 2011* (Vol. 6947, pp. 376–391). Berlin, Heidelberg: Springer Berlin Heidelberg.

Lawley, J. & Tompkins, P. (2008). Maximising Serendipity: The Art of Recognising and fostering Potential.

Leong, T. W. (2009). *Understanding serendipitous experiences when interacting with personal digital content*. The University of Melbourne.

Leong, T. W., Vetere, F., & Howard, S. (2008). Abdicating choice: the rewards of letting go. *Digital Creativity*, *19*(4), 233–243.

Levy, S. (2006). The Perfect Thing. Simon and Schuster.

Makri, S., & Blandford, A. (2012). Coming across information serendipitously–Part 1: a process model. *Journal of Documentation*, *68*(5), 684–705.

McCay-Peet, L., & Toms, E. G. (2010). The process of serendipity in knowledge work (pp. 377–382). Presented at the Proceeding of the third symposium, New York, New York, USA: ACM Press.

Merton, R. K., & Barber, E. (2004). *The Travels and Adventures of Serendipity*. Princeton University Press.

Murray, J. H. (2012). Inventing the Medium: Principles of Interaction Design as a Cultural Practice. MIT Press.

Pariser, E. (2011). *The Filter Bubble: How the New Personalized Web Is Changing What We Read and How We Think*. Penguin Group US.

Rubin, V. L., Burkell, J., & Quan Haase, A. (2011). Facets of serendipity in everyday chance encounters: a grounded theory approach to blog analysis. *Information Research*, *16*(3).

Van Alstyne, M., & Brynjolfsson, E. (1996). Electronic communities: Global village or cyberbalkans. *MIT Sloan School.*

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Towards Enactive Systems: Affective Cane

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Keywords

Art and TechnoScience, collaborative transdisciplinary research, expanded sensorium, enactive affective systems, reengineering of life, affective cane, physiological, environmental sensors, data visualization

Abstract

The TechnoScience territory for artistic experimentation at LART propitiates collaborative networked practices of Brazilian high-level researches in the context of New Leonardos collective intelligence and practices. The focus on radical digital domain applied towards enactive affective systems, related to human experience facing technologies, expand art manifestations to fields of embodied cognition and body apparatus living in. The sense of presence and actions in daily life for transformations allowed trough technologies are the main secret topics that must be analyzed when envisioning the creative technologies and innovation for the expanded sensorium and aesthetic responsive changes of the sensorial apparatus. Knowledge, methodologies and practices mixed to ethnographic issues and objectives look for the integration of body sensors, computer vision, GPS and networked connections, environmental laws, and mutual and reciprocal responses in data visualization. We developed an affective cane prototype, which has been designed to enable the active participation of people with disability or reduced mobility supporting their autonomy, independence, improved quality of life, and social integration, using the idea of affective enactive systems together with mobile technology. Enactive affective systems mapping affective narratives collaborate for the end of “nature itself” and the emergence of a “future healthier engineered reality".

I. INTRODUCTION

Collaborative practices in Art and TechnoScience are problem-centered and strive to meet societal challenges with uncommon insights, diverse techniques and methods for innovation envisioning the planet life´s challenges: education, biodiversity and health. Researchers integrate labs and groups, creating a context where professors, technicians and students collaborate with the objective of trigger innovative solutions. Creative technologies deal with cross knowledge inside radical fields for covering disruptive innovation, beside the industries and market, for bringing solutions to the contemporary the ways of living. Our central focus are the health challenges: biological, environmental and social behaviors. The New Leonardos Program, term proposed by the Leonardo Organizations, International Society for Science, Art and Technology (ISAST) chaired by astro-physicist Roger Malina, cover our expectation in terms of methodologies and institutional structure for application within the culture. The transit of disciplines in trans or antidisciplinar methodologies brings together researchers with a diverse range of interests and expertise. Society’s scientific development with consequent anthropological issues and artistic and scientific discoveries require New Leonardos actions, and a team in collective intelligence. Trying to synthesize the genius, the Group acts in a bottom-up atmosphere, putting together people who cannot stand in rigid environments, and seeking the more challenging and fertile integration between areas. Among the variety of study objects, everyone produces knowledge, without hierarchical working relations. These collaborations also serve as an ongoing cross-education within the working group broadening the participating researchers experience while retaining full disciplinary depth and expertise.

The LART − the Laboratory of Art and TechnoScience, at the University of Brasilia at Gama (UnB/FGA) founded in 2010 by Dr. Domingues and implemented in the CNPq - National Research Board the respective Research Group composed by artists, engineers and

scientists from several areas is one of the followers of the New Leonardos philosophy. LART's general proposal expands pioneer investigations in Brazil in Interactive Art [1], [2], [3], [4] toward the profound levels of Art and TechnoScience and disruptive innovations in bioart and mhealth [5], [6] e [7]. The condition for such research is to combine the repertory of scientific topics for shared plans with other Unb and Brazilian Labs. The rich curriculum of scientists and artists and their repertory with recognized background, in collaboration with Dr. Domingues, pioneer researcher in art, science and technology, allied to the state-of-the-art in scientific developments by Rocha [8], Miosso [9], Fleury [10, 11], and the energy of young academic graduate students are the main fertile seeds for the humanistic and social perspectives in creative skills for innovative medicine in biomedical engineering. Advanced levels of research establish intertwined collaboration between practices and theoretical approaches. In the Sensor Lab as well in the Science, Tecnology and Health Program, Ceilândia Campus, Prof. Silvana Funghetto at Physiological Lab at University of Brasilia (UNB) has collaboration with LART for discussing several issues involving m-health, physiological signals in daily life and mobility. Prof. Gilda Assis from University of Ouro Preto (UFOP) has started collaboration with LART researchers in augmented reality and computer graphics areas. In addition, LART have high level Brazilian collaborative researchers, such as Prof. Dr. Ricardo Torres from the RECOD Lab, founded at the Institute of Computing (IC), Unicamp, in 2009 and started to host and foster projects on complex data in straight. Computer Vision, Information Retrieval, Machine Learning and Digital Forensics. Other collaboration is with Dr. Cecila Baranauska, reference on Human-Computer Interface and Cordinator of the Project: Socio- Enactive Systems, Unicamp/Fapesp.

The transit of disciplines as software engineering, energy engineering, electronic engineering, automotive engineering and aerospace engineering, specially the advanced researches in biomedical engineering confirms the urgency for eliminating the barriers between types of knowledge and immediately integrate common issues of several areas. To respond the complex questions of life we must integrate our investigations in Bioart and M Health [12], [6], [13], [14], in the territory of freedom of experimental art which puts experts in an area of dissipation and create cognitive frameworks, working procedures, communities of interest and methods of dissemination by mixing rationality, intuition, and emotion.

In the border area of disciplines shared objects go for extremes, and the excess where art and science contaminate each other. Image science in data visualization of biological and cosmic life, besides, the humanities' ethnographic method is necessary to understand human acts by the effects of seamless, nomadic, mobile [15] and ubiquitous condition [16].

The design of enactive affective systems[1], from invisible computers, calm technologies, transparent interfaces {16} increasingly mixed to life thanks to mobile technologies and locative interface are topics to understand how life is and how calm and intuitive connections are mixed in daily life. Artistic intervention in scientific environment and scientific laws in art arouse another reality of problems and possibilities. Aesthetic theories of modernity become obsolete under the more complex factors of properties of the immaterial culture and art based on processes and scientific laws. Changes in the human scenario based on networks, mobile technologies, and pervasive-sentient interfaces require the forming of professionals for scientific and social interventions and collective contributions.

The Reengineering of Life and innovative technologies: enactive affective systems

LART and the collaborative researches responsibility and urgent attention to life reengineered in ontological levels of creative technologies consider three axes: (i) sensorium and affective enactive systems reengineering by microsensors and physiological synaesthetic signals in daily life; (ii) nature and biodiversity challenges reengineering to face the infirmity of landscapes in the sense of affective geographies in Brazil's huge territory, facing dengue, and also the preservation of species in Amazon rainforest biomes; (iii) culture reengineering by envisioning the infirmity of landscapes, and the role of social platforms, associated to the ubiquitous condition provided by sentient technologies [18] and enhancing awareness of human presence amplified by mobile technologies, providing a socially and healthy reengineered nature in extreme, hostile environments.

In this proposal, we explore the axe 1, the condition of life enhanced by biofeedback devices and mobile technologies, which transform our notion of body. Wireless devices and the possibilities of affective mobile computing modify the traditional concept of ecosystem, by allowing informational flows, biofeedback and affectiveness in an ecolocated world[2].

The beginning of the project is based on the entitled 'Reengineering Life: Creative Technologies for the Expanded Sensorium', international collaboration between LART/FGA/CNPq and the Camera Culture Media Lab at the Massachusetts Institute of Technology (MIT). Through this project, members of the LART research group have the opportunity to work in the environment of Camera Culture Media Lab at MIT, an institution synonymous with transdisciplinary work, and where creativity and innovation

[1] We amplify the concept of enactive systems by Tikka [21], dedicated to the movies and images; this amplification leads to the affective enactive systems, dedicated to the daily life and sensorial data.

[2] Research supported by the Brazilian Ministry of Education (CAPES) and Ministry of Science, Technology and Innovation (CNPq), and also International Exchange with the OCAD University in Toronto and the CIV-DDD.

are main premises for any starting idea. An important benefit of our enactive affective system is the fact that it integrates Bioart and Health and includes the study of Brazilian rituals in Arts, Humanities and Sciences. The prototype of an affective insole for diabetics was produced as an embedded system to analyze human actions and includes variables that allow us to infer not only movement, kinesiology (proprioception), but also physiology and synesthesia. In transphysiological dimension it is explored aspects of motion, electricity, graphic design, in data visualization and data sonification. Body movements, gestures, postures, fragmentation, reinstatements, dynamics, internal-external connections and motor schemes, dealing with gestures, rhythms, not only at each stage of the movement, but also considering what affects you, the environment and the coupled interior and affection in the flows of life with affective enactive sensors. Biofeedback with outside environment in enactive affective conditions can help understanding the internal excitation of nerves or the immediate impression of the senses, or by a complicated chain of senses' impressions, previously experienced, stored in the memory of sensations, emotions and thoughts. Attempts are being made for the system to read the rhythmic patterns of movement. The daily life and affective narratives of diabetics are the contribution for mhealth.

In the main senses, anthropological issues of mobile condition amplify the phenomenology of "being here" [19], altered by the use of cell phone mob cameras [20], and locative and geographic interfaces enhanced by sensorial data and physiological enactions to the environment. The newest development of LART is an enhanced cane, called affective cane which use the principles of the theory showed above.

The affective Cane: enactive system for cognition, mobility and freedom.

The purpose of this work is to collaborate in the field of cognitive computing, related to ethnographic methodologies and strategies for practices with the objective of promoting mhealth and well-being. The prototype to be commercialized will integrate the list of technologies of Internet of Things by representing an enactive affective system.

Such enactive affective system is an embedded system composed of a regular cane and sensors that supports the locomotion and aids to recover the possibility for helping people with mobility difficulties. It also allows mobile communication using technologies of location and ubiquity. One of the goals is to avoid unbalance in gait and falls, by monitoring walking and providing tactile or auditory feedback to alert the individual when there is a potential risk of falling. In this case, the cane would "talk" to the user, performing a check-up implemented through a protocol of questions, filming the face or eyes, measurement the temperature variation in the hand, measuring blood Oxygen Saturation levels - the heart and breathing rates or in the pattern of the patient's footprint, gait rates.

Furthermore, in the case of a fall, the cane is able to identify the event by the accelerometer and a gyroscope data. It initiates a check-up protocol concerning spatial orientation (angulation), velocity, with previously recorded information to determine if a serious injury occurred. Also, it notifies useful information if the person is potentially risk, for a stroke, heart attack or convulsion. The system as a mobile device is also able to inform the individual's location to the family or caregivers through GPS and to communicate the incident via portable devices.

The biggest qualities to frame the cane as an affective system are its capacities coming from the physiological sensors for capturing and reveal the body actions in its mutual and reciprocal effects to the environment. How the environment affects the body and how the body itself is affected by the environment? (Figure 1).

Figure 1: The Affective Cane enactions with the environnent . Photo of the Brasilia's Cathedral.

The physiological data and the environmental data in dialogue with signal processing generated during the living narratives, transmitted, become an affective system that records the exchanges or the enactions (body in action) with the environment and the results of the cane data visualization. The system registers the exchanges of body–environment narratives and creates living maps that can be 'returned'.

The prototype innovates as a prosthetic enactive affective system in the sense that Massumi takes the Spinoza's [22] affectus as an ability to affect and be affected when connected to the environment. It is not in an emotional way, but in a biological manner, having as a basis the sense of 'biograms' [23] as topological lived situation, where individuals are challenged by obstacles, situations, and episodes that trigger behaviors in a 'whole organic' way.

Our prototype of sensors expands the body locative interfaces with signal processing and decision-making, allowing methods to reveal synaesthetic maps in data visualization and spatial navigation of the walking intensity as variables of affective exchanges experienced in relation to the topologies. The "ecological perception" [24] combining different nature of sensors and the different displacements of

organisms in this application is dedicated to mHealth and the stories of elder people embodied actions lived in constant negotiation between body and the environment. We record the responses of structural coupling between body–environment [25] and the body act on space in a synaesthetic way. We obtain living maps of the walking scenes and the variations of topologies that provoke several biograms recorded in a body's topographical memory [26]. That displacement within the space makes us remember that biograms are topological lived events [27].

The cane episodes measure the experience of aging and inform about the conditions to deal with biological transformations, and physiological changes regarding human organism in levels and in manners of evolutive needs, in the case of their displacements and the environmental conditions. We emphasize the physiological modifications in the corporeal composition from reduction of the muscles' strength, range of motion, velocity of contraction to postural alterations [28] [29]. In view of the aforementioned alterations, it is observed that there is a reduction in the ability of performing of daily activities and functional capacity often triggered by a decrease in muscle mass called sarcopenia [30], which can increase the susceptibility of falls and fractures.

These technically augmented devices have been developed with the help of potential users who have been contributing with valuable information about the product in order to highlight their needs and the needs of their caregivers.

In addition, the use of the device in its real context provides a richer source of data: to extract spatial and temporal patterns of use and behaviors associated physiological status, environmental conditions, to the interrelationships between them. At the same time, by increasing the use of augmented systems by elderly users, it will produce data streams specific to this demographic group, generating a great resource of information that can be used to better provide data for them.

II. Development of the Affective Cane

From a perspective of design and creative technologies, it is important to contextualize the use of the walking cane in the health area. The cane is classified as a Locomotion Assistance Device or as an Auxiliary Walking Device (AWD). In clinical practice, the choice of the AWD model to be prescribed differs according to the need of each patient and their financial condition. All these devices can help solve problems of balance, pain, fatigue, weakness, joint instability, excessive skeletal load, and esthetics. Professionals experienced in clinical practice, among them, physical therapists, should be the ones to guide users in the use of each device for each specific user, for avoiding the risk of injury or falls, and worsening of their physical condition [37].

The participants themselves performed tests with force and motion detection and prepared mathematical and physical analyses, as well as visualization schemes [41], which facilitate data interpretation.

An integrated hardware and software solution incorporating multiple locational, physiological, environmental, and mobile communication sensors were embedded in the cane so that specific algorithms can be developed to capture signals that can assess the possible imminence of stroke, infarction, and seizure, issuing an automated alert to caregivers about possible falls [33] [39] (Figure 2).

This intelligent cane prototype CPU is an Arduino Uno, and all its peripherals were built in a single shield board, thus facilitating portability (Figure 3 and 4).

The current prototype (V4.0) have features distributed in three main blocks, regarding the main functions of a typical cane. Each one is described as follow:

- Module 1 (Environmental): This module is responsible for gathering the environmental context of the user. The system can gather basic information about weather and temperature and use this data to better recognize its surroundings. The features of this module are:

  - Ambient Temperature (in Celsius) and Relative Humidity (in percentage). The responsible sensor is the DHT11 (AOSONG Electronics Co., Guangzhou, China). This is an integrated microcontrolled device capable of exporting temperature and humidity data through a serial connection at the sampling rate of 0.5 Hz. [34] [36].

  - Ambient Light (in percentage). The responsible sensor is an LDR (Light Detecting Resistor). This sensor voltage is obtained by a simple voltage divider, and then compared to a bias. Low luminosity corresponds to a small sensor output, and vice versa. [36]

- Module 2 (Locativity): Aligned with Module 1, this second module completes the environmental data with spatial facts of the user and the cane itself. Data regarding the inclination and distance from the floor are constantly being sampled by the cane. The features of this module are:

  - Angular rotation in three dimensions (also known as Yaw, Roll and Pitch) in Degrees. The responsible sensor is the MPU6050 Accelerometer and Gyroscope. (INVENSENSE, San Jose, USA). By using a complimentary filter implemented in software, both data given by the sensor are fused, resulting in the given angles. Data is then filtered to eliminate the associated noise [40].

- Distance from the floor in centimeters. The responsible sensor is an Ultrasonic Distance Sensor (HC-SR04). This device emits a sound and measures the delay of its echo, then calculating the distance from any object (in this case, the floor). [35].

- Cane ground touch sensor. The responsible sensor is a FSR (Force Sensing Resistor). From a simple voltage divider, we identify the resistance of the component, which varies according to the pressure exerted on it. A low resistance indicates a high pressure and vice versa. The pressure value is then compared to a threshold, and if this value is below, it is considered as non-pressed. And if it is above, it is considered as pressed.

- Global Positioning System (GPS). The responsible sensor is a NEO-6M module and a GPS Antenna.

• Module 3 (M-Health): This module interacts directly with the cane's holder by continuously monitoring its physiological signals in a non-invasive fashion. This way, the cane can be aware of its user, without disturbing its walk. This is the most challenging module to develop, due to the nature of the signals it deals with (small amplitude, and very susceptible to noise), and therefore is still a work in progress. The feature of this module in the current cane version is:

o User's hand temperature [38], in Celsius. The responsible sensor is a thermistor. The thermistor is a component whose resistance varies with temperature. A signal conditioning circuit generates an output voltage which is related to the measured temperature. This signal is useful as an indicator of many maladies, such as stress, anxiety, and as second effect of inflammations.

Besides the three modules, the developed prototype also has some user-oriented features. These facilitate the interaction between the user and the system. The features are the following:

- OLED Monitor for system viewing (Model: SSD1306). Functionality: Small 0.6 " flexible monitor for human-computer interface of the cane.

- Real Time Clock (Model: DS1307). Functionality: A real-time clock that allows the system to provide the user of the Affective Cane with a permanent sense of time.

Finally, the embedded software was developed with time accuracy and continuous operation in mind. That said, the system has low energy consumption (can survive days with only a E-type 9V battery), Bluetooth communication capabilities and fast responses to events. The next prototype (V5.0) (Figure 2) will focus on the M-Health modules, gathering more biomedical information from user, such as its galvanic skin resistance, Hearth rate, blood oxygen saturation rate (also known as SPO^2 rate)

Figure 2: Affective Device attached in a regular cane (SolidWorks).

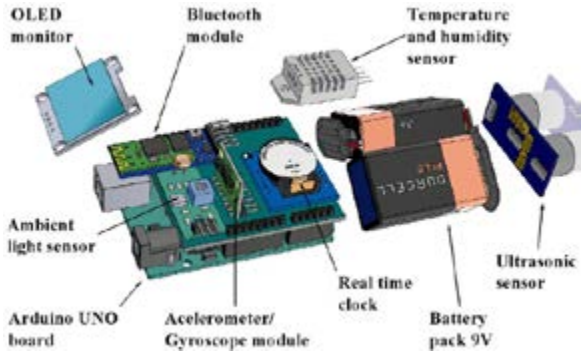

Figure 3: Hardware package embedded in the Affective Cane.

Figure 4: Assembly of the case of sensors for Affective Cane.

Data Visualization

The validation process was done in conjunction with the visualization of the data issued by the cane. The methodology used was a video analysis of common situations and potential hazards, such as: the person walking on a smooth floor with obstacles, a sloping ramp and a small ladder.

A data viewer was developed using Processing software. The programming of this viewer includes:

- Touch analysis on the floor when the color of the floor changes color by FSR sensor;
- Ambient temperature' evaluation, when the color of the screen changes according to the temperature gradient from hot (red) to cold (blue) by DHT11 sensor and
- Spatial position of the cane is also measured along the three axis of rotation (X, Y and Z) with data from the gyroscope/accelerometer, see Figure 5 to 7.

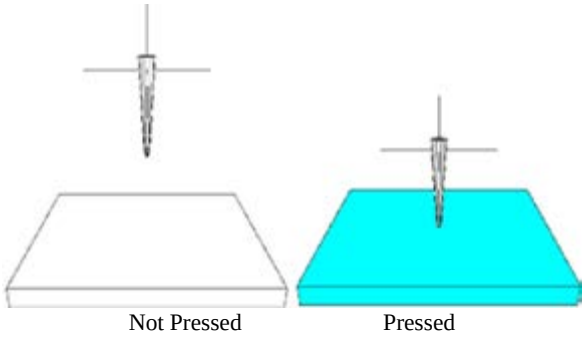

Figure 5: Data visualization of the Affective Cane – Touch analysis

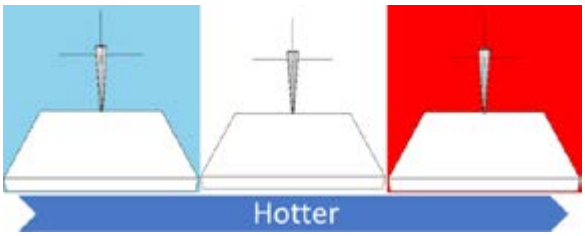

Figure 6: Data visualization of the Affective Cane – Temperature variation

Besides, another data visualization, based on proof of concept, was proposed in the software Blender.

A sensor: FSR (Force Sensing Resistor) generates continuously pressure values. Each pressure value is then compared to a threshold, and if this value is below, it is considered as non-pressed. And if it is above, it is considered as pressed.

Data classified as pressed were used as input for the animation to use as outreach material. The sensor data were used as a scale factor to determine the translation on the y axis (height) to be applied on some faces of the plane (ground), producing an effect of "stepped" in a deformable plane.

Solid Works 3D model of the affective cane was exported to STL format, then the STL file was converted to 3DS and finally imported into Blender.

When the cane collides with the plane (ground), a "deformation" occurs on the patch of collision cane-plane and on nearby patches within a radius of action, randomly selected at each step, see Figure 7.

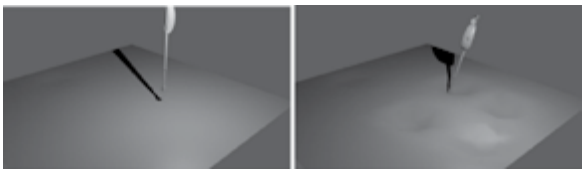

Figure 7 – Frames extracted from Blender animation showing the "morphing of the ground.

A more technical version of this work was presented in the conference VSMM 2017 - International Society of Virtual Systems and MultiMedia, however with a focus on the area of Computer Science. In the article for the VSMM was presented the prototype of 2017 of the affective cane and its previous results for its development.

The next step in test target users such as seniors and people with locomotion difficulties to adjust the system to have a greater precision and to amplify the application for smartphone integrated to the affective cane.

III. Conclusion: Relevance and Impact Claims

A. Social Impact: Empowering Impaired People

According to the World Health Organization, in 2011, over 1 billion people globally experienced disability. Furthermore, 1 of 2 of impaired people cannot afford health care. In this scenario, the development of cognitive computing systems that can be used to construct assistive devices and technologies that can enable people with disabilities to be independent is of paramount importance.

The investigation proposed in the context of this project addresses these issues, by allowing the identification of novel cross-modal-sensor-based enabling technologies that can be made commercially available in the future. The foreseen technologies are expected to take advantage of cutting-edge solutions and approaches available in the area of machine learning, computer vision, and information visualization. We will develop cognitive computing system prototypes, ethnographic methodologies, and strategies for practices in the domain of technologies for health and wellbeing. These prototypes support the active participation of people with temporary or permanent reduced mobility or disability, promoting autonomy, independence, improved quality of life, and social integration.

In order to be successful in this endeavor, we need to re-imagine life within this hybrid condition, or better, biocybrid condition, (bio +ciber data) and hybrid - the word qualities) to invent the ways in which it can support an individual's life history/life narratives, increasing the quality of life, prolonging

independence, promoting dignity, social contact and integration within communities. Affective exchanges [42] configure biological components to "ecological perception" [24], says Diana Domingues, or the reciprocal influence body/environment and the feedback flux that are shaped by the vital signals and the dialogues with the locations. In terms of the seminal urban life, E-topia and mobile connectedness confirm William J. Mitchell's premise: wear/where and aware [43].

But normal canes are only helping devices: although they have can prevent some events, they cannot do much more. In this sense, the developed cane is an improvement over a normal cane in the sense that it cannot only foresee many other health problems related to their physiological sensors, but also sense the environmental context in which someone using the cane is inserted.

The results obtained this far in the ongoing research project were the development of a walking Stick and differs of the other single embedded electronic system. It provides a complex embedded sensorial perceptive expansion and supplementation, aiming to increase the quality of life, functionality and independence of people in their daily activities. Fortunately, we have many new tools available to collect, manage, analyze, and disseminate data. The development of low-cost low-power sensors increasingly deployed objects of common use and linked to mobile processing and communications, an 'internet of things', enables the monitoring of environments and interactions at unprecedented levels. These sensors allow the collection of physiological data in real-time from active human and non-human agents while simultaneously monitoring environmental conditions. These can be concatenated into databases and merged with others that can give new understandings, histories, and epidemiology. Thus, new questions can be posed and new understandings developed.

B. Social Impact: Trans-disciplinary Research

There are challenges in understanding the complexity of the problems we face and in formulating approaches that lie beyond traditional disciplinary bounds. There is the task of developing methods to correlate incompatible data sets, process large and complex databases, and to extract and communicate comprehensible regularities from them. To do so the capacities of any single discipline are insufficient, instead a new approach is required, combining researchers from many fields of knowledge.

While research at the intersection of technoscience, the arts, health, and environment, has been of the essence researchers and groups in this proposal, the network must be strengthened, broadened, and deepened if it is to have a greater impact. A new generation of researchers must be trained capable of understanding socio-environmental problems in depth, not limited by disciplinary perspectives, and capable of dialogue across a wide range of stakeholders. There are two scientific hubs in this proposal: Computer Science, whose research activities will be led by the RECOD Lab, Institute of Computing, University of Campinas; and Health, Arts, Humanities, and Sciences, led by the LART Lab, University of Brasília.

ACKNOWLEDGMENT

This research used resources from grant #2015/165280 from São Paulo Research Foundation (FAPESP). Authors are grateful to UnB, Unicamp, CNPq, CAPES, and FAPESP for their funding support.

References

[1] Stephen Wilson, Art + Science Now, London: Thames & Hudson, 2010.

[2] Stephen Wilson. Information Arts: Intersections of Art, Science, and Technology. Cambridge, Massachussets: The MIT Press, 2002.

[3] Oliver Grau. Virtual Art. From Illusion to Immersion. Cambridge- MA: MIT press, 2003.

[4] Edmond Couchot. La Technologie Dans L' Art – De la photographie à la réalité virtuelle. Nîmes, Éditions Jacqueline Chambon, 1998.

[5] Louise Poissant and E. Daubner (org.), Art et Biotechnologies Presses de L'Un. du Québec, Montréal, 2005.

[6] Ted Krueger. "Design and prosthetic perception", Kybernetes, Vol. 36 Iss: 9/10, pp.1393 - 1405, 2007

[7] Diana Domingues. Art Interactif, corps couplé et sentiment post-biologique. In: SOULAGES. (ed). Dialogues Sur L'Art et La Technologie. Autour d'Edmond Couchot. Paris: L'Harmattan, 2001, v., p. 123-138.

[8] Adson F. Rocha. As redes de sensores e o monitoramento da saúde humana. In: BRASIL, Lourdes (Org.) Informática em Saúde, Ed.: Brasília: Universa, 2008, pp. 489-510

[9] Cristiano Jacques Miosso, R. von Borries and J. Pierluissi. Compressive Sensing with Prior Information: Requirements and Probabilities of Reconstruction in l1-Minimization. IEEE Transactions on Signal Processing, volume 61, issue 9, pages 2150 to 2164. http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=6374697

[10] M. C. Reis, A. F. Rocha, J. L. Carvalho and S. Rodrigues, 'Insole with pressure control and tissue neoformation induction systems for diabetic foot', Proceedings of the 32nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, 32nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, 2010:2010, pp. 5748–51.

[11] Suélia de S. F. R. Rodrigues, A. F. Rocha and J. C. Carvalho. Prosthesis for flow control in the esophagus as a new technique for the treatment of obesity. In: Aleksandar Lazinica. (Org.). Biomedical Engineering / Book 2. 2ed.: InTech, 2012, v. 2, p. 20-28.

[12] d'Ernestine Daubner and Louise Poissant (Org.). Bioart: Transformations du Vivant. Québec: Presses de l'Université du Québec, 2012.

[13] Ted Krueger. "Devices for the Perception of Magnetic Fields." Enaction in Arts: Proceedings of the Fourth International Conference on Enactive Interfaces. (enactive07). 133-6, 2007.

[14] Diana Domingues and Günther Johannes Lewckuk Gerhardt. Échanges de signaux eléctriques humains et de la poétique de l´art immersif. Poetics. In: Poissant (Org.), Bioart: Transformations du Vivant. 1ed. Montreal: Presses de l´Université du Québec, 2012, v. 1, p. 121−146.

[15] Manuel Castells, J. L. Qiu, M. F. Ardévol and A. Sey. Mobile Communication and Society: A Global Perspective. Cambridge, MA: MIT Press, 2007.

[16] Mark Weiser. The computer for the twenty-first century. Scientific American, pp. 94-100, September 1991. Disponível em: http://web.media.mit.edu/~anjchang/ti01/weiser-sciam91-ubicomp.pdf. Acessado em maio de 2009.

[17] M. Kaipainen, N. Ravaja, P. Tikka et. al. Enactive Systems and Enactive Media: Embodied Human-Machine Coupling beyond Interfaces. LEONARDO, Vol. 44, No.5, pp.433-438, 2011.

[18] Howard Rheingold. Smart Mobs: the next social revolution. Basic Books: Cambridge, MA, 2002.

[19] Roland Barthes. Camera Lucida: Reflections on Photography. New York: Hill and Wang, 2010.

[20] Oliver Bimber and Ramesh Raskar. Spatial augmented reality: merging real and virtual worlds. A K Wellesley, MA: Peters, Ltd. 2005.

[21] M. Kaipainen, N. Ravaja, P. Tikka et. al. Enactive Systems and Enactive Media: Embodied Human-Machine Coupling beyond Interfaces. LEONARDO, Vol. 44, No.5, pp.433-438, 2011.

[22] Spinoza, B. de. 1994. Ethics. New York: Penguin Books.

[23] MASSUMI, B.. 2002. Parables for the Virtual: Movement, Affect, Sensation. Parables for the Virtual. 4th ed. Durham, NC: Duke University Press Books. doi:10.1215/9780822383574.

[24] GIBSON, James J. 1986. The Ecological Approach to Visual Perception. Of Experimental Psychology Human Perception and. 1st ed. Vol. 39. Hove: Psychology Press.

[25] MATURANA, H. R., and VARELA, F. J. 1987. The Tree of Knowledge: The Biological Roots of Human Understanding. Boston, MA: Shambhala Publications.

[26] BERTHOZ, A. 2002. The Brain's Sense of Movement. Cambridge, MA: Harvard University Press.

[27] Tiago Franklin R. Lucena, Suélia Rodrigues Fleury Rosa, Cristiano Jacques Miosso, Ricardo da Silva Torres, Ted Krueger, Diana Maria Gallicchio Domingues: Walking and health: an enactive affective system. Digital Creativity 27(4): 314-333 (2016).

[28] GOODPASTER, B. H.; PARK S.W.; HARRIS, T. B.; KRITCHEVSKY, S. B; NEVITT, M.; SCHWARTZ, A. V., et al. The loss of skeletal muscle strength, mass, and quality in older adults: the health, aging and body composition study. The journals of gerontology Series A, Biological sciences and medical sciences. [Research Support, N.I.H., Intramural]. 2006 Oct;61(10):1059-64.

[29] PINHO Tatyana Ataíde Melo de, Silva Antonia Oliveira, Tura Luiz Fernando Rangel, Moreira Maria Adelaide Silva P., Gurgel Sandra Nagaumi, Smith Adriana de Azevedo Freitas et al . Avaliação do risco de quedas em idosos atendidos em Unidade Básica de Saúde. Rev. esc. enferm. USP [Internet]; 46(2): 320-327, 2012.

[30] MELTON L. J. 3rd; KHOSLA S.; CROWSON, C. S.; O'CONNOR, M. K.; O'FALLON W. M.; RIGGS B. L. Epidemiology of sarcopenia. Journal of the American Geriatrics Society. [Research Support, U.S. Gov't, P.H.S.]. 2000 Jun;48(6):625-30.

[31] MIT-CNPq, Previous prototype: Reengineering Life: Creative Technologies for the Expanded Sensorium. Program MIT International Science and Technology Initiatives 2011 MIT-Brazil Seed Fund/CNPq – Coordinators Adson Ferreira da Rocha and Diana Domingues - American Research Leader: Ramesh Raskar/MediaLab-MIT Camera Culture The sensorized insole.

[32] E. Sazanov and M. Newman, "Wereable Sensors. Fundamentals, Implementations and Applications", 2017. Elsevier.

[33] H. Ahmed and M. Tahir, "Improving the Accuracy of Human Body Orientation Estimation With Wearable IMU Sensors," in IEEE Transactions on Instrumentation and Measurement, vol. 66, no. 3, pp. 535-542, March 2017.

[34] Y. Wang and Z. Chi, "System of Wireless Temperature and Humidity Monitoring Based on Arduino Uno Platform", 2016 Sixth International Conference on Instrumentation & Measurement, Computer, Communication and Control (IMCCC), Harbin, 2016, pp. 770-773.

[35] C. G. Raghavendra, S. Akshay, P. Bharath, M. Santosh and D. Vishwas, "Object tracking and detection for short range surveillance using 2D ultrasonic sensor array," 2016 International Conference on Circuits, Controls, Communications and Computing (I4C), Bangalore, 2016, pp. 1-4.

[36] T. Karvinen, K. Karvinen, and V. Valtokari, "Make: Sensors A Hands-On Primer for Monitoring the Real World with Arduino and Raspberry Pi.", 2014, Maker Media, Inc.

[37] R. Sainsbur and G. P. Mulley. "Walking Sticks Used by the Elderly." British Medical Journal (Clinical research ed.) 284.6331 (1982): 1751.

[38] E. B. Blanchard, B. Morrill, D. A. Wittrock et al. "Hand temperature norms for headache, hypertension, and irritable bowel syndrome". Biofeedback and Self-Regulation (1989) 14: 319. https://doi.org/10.1007/BF00999123

[39] O. Almeida, M. Zhang and J. C. Liu, "Dynamic Fall Detection and Pace Measurement in Walking Sticks," 2007 Joint Workshop on High Confidence Medical Devices, Software, and Systems and Medical Device Plug-and-Play Interoperability (HCMDSS-MDPnP 2007), Boston, MA, 2007, pp. 204-206.

[40] K. Kim, Jun Seok Kim and Young Joon Kim, "Application of nonlinear complementary filters to human motion analysis," 2015 17th International Conference on E-health Networking, Application & Services (HealthCom), Boston, MA, 2015, pp. 594-595.

[41] N. F. Ribeiro and C. P. Santos, "An intuitive visual interface for a real-time monitoring system for human gait using IMUs," 2017 IEEE International Conference on Autonomous Robot Systems and Competitions (ICARSC), Coimbra, 2017, pp. 153-158.

[42] PICARD, R. Affective Computing. MIT Press, Cambridge, 1998.

[43] MITCHELL, William J, E-topia: "Urban life, Jim--but not as we know it". Cambridge, MA: MIT Press, 2000.

[44] MALINA, R. Leonardo olhando para frente: Fazendo a história e escrevendo a história. Em: DOMINGUES, Diana (Org.). Arte, Ciência e Tecnologia: Passado, presente e desafios. São Paulo: Editora UNESP, 2009.

for the sleepers in that quiet earth.: Experiencing the Behavior of a Deep Learning Neural Network Agent through a Generative Artbook

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Abstract

This paper describes an artbook created through the adaptive behavior of a deep learning neural network computational agent as it "reads" a novel. Through this process, the agent builds a model of the syntactic and stylistic principles behind the original text and uses this model to generate new, unforeseen content. A limited set of unique printed copies of the artbook are generated through this process. Each unique edition of the work thus embodies the learning process of the agent as it goes through the adaptive process, one wherein the agent begins from a state of randomness and gradually refines its output as it reads the novel. I examine the text through an analysis of generated excerpts, discussing how they reveal the behavior of the system as an adaptive agent. Practical and theoretical implications are discussed in the context of generative literature, machine learning, and behavior aesthetics.

Keywords

Agent-based Art, Artbooks, Behavior Aesthetics, Deep Learning, Generative Literature, Long Short-Term Memory, Machine Learning, Natural Language Processing, Neural Networks.

Introduction

for the sleepers in that quiet earth. is a computer-generated artbook produced through means of a deep learning, recurrent neural network agent known as a *long short term memory* (LSTM) [3] as it processes or "reads" *Wuthering Heights* – the only novel penned by Emily Brontë, published one year before her death [2]. The work is published in a limited edition of thirty-one (31) unique copies (Bad Quattro, editor: Nick Montfort). The agent encounters the text character by character, familiarizing itself with these syntactical and styllistic materialities of the original text. As it reads and re-reads the book, it slowly reinterprets Brontë's style within the constraints of its own artificial "body", hence finding its own unique "style" or "voice", so to speak.[1] The resulting work unfolds a new narrativity where the reader encounters and experiences directly the adaptive behavior of a learning agent.

The project attempts to subvert how deep learning systems such as LSTMs are used in usual scientific and engineering practice by conflating it with the words and imagination of a 19th century female author.[2] Normally, such systems are aimed at optimization: they iterate over a database (for example, a huge corpus of text extracted from diverse sources) until they converge to an optimal state. The trained neural network can then be used in text-related applications such as speech recognition and automated translation.

In the arts, deep learning recurrent neural networks have largely been used as a means of exploring the aesthetic fruits and limitations of the machine learning process: for example, consider *Sunspring* (2016), a science-fiction movie based on a screenplay generated by a LSTM agent named "Benjamin" which was trained on a databse of sci-fi screenplays.[3] Or 2017 project *Rerites* by David Jhave Johnston, a collaboration between the author and a quasi-recurrent neural network (Q-RNN) to create a series of print-on-demand poetry books.[4]

for the sleepers in that quiet earth. takes an alternative approach to these artistic works by engaging in a literary embodiment of the cognitive gestures of the agent, focusing on the agent's learning *behavior* in all of its deficiencies and unpredictability. Through this work I explore how computation allows for the emergence of a new artistic practice which Simon Penny has described as "behavior aesthetics" [6]. This new domain considers the behavior of artifical agents as a medium for artistic creation – comparable to media such as video, photography, etc. which come with their own sets of effects, affects, materialities and affordances. In general, behavior aesthetics presupposes the presence of an embodied agent interacting in real-time in the real world.

The project, generated by a disembodied agent, yet printed on unique paper copies, resides in a liminal space, as it borrows certain elements from behavior aesthetics, but also from generative poetry and algorithmic art. In this article, I explore the project through an examination of the

*This research was initiated and conducted as part of my post-doctoral studies at the Comparative Media Studies/Writing, Massachusetts Institute of Technology, Cambridge, MA.

[1] Brontë's work was originally published under a gender neutral pseudonym, and years later was deemed "monstrous" by some critics, seeming to dole out unreasonable punishment to its characters who fell victim to their burning passions. This juxtaposition of computational agent with a 19th century author invokes yet another monstrous perversion of consciousness, or perhaps subconsciousness, as the new author learns nothing else of the world but the syntactic patterns of the original tale.

[2] The status of agent as object and objectified resonates with the sometimes questionable status given to non white-male authors in the past.

[3] http://www.imdb.com/title/tt5794766/

[4] http://glia.ca/2017/rerites/

work itself and a review of the creative process of producing the work using machine learning neural nets. This is followed by a discussion about the nature of the work in relation to behavior aesthetics.

The Work

Most of my work over the past decade has been focused on the design of computational artificial agents, and documenting the performance behavior of these agents in the real world. For example, in my series of site-specific interventions *Absences* (2008-2011), I created small, autonomous, ephemeral agents that acted within natural environments such as forests and mountains. My robotics installation *Vessels* (2010-2015), created in collaboration with Samuel St-Aubin and Stephen Kelly, involves a group of autonomous, water-dwelling robots that react collectively to their environment through an emerging group behavior. Through this earlier research I have developed an interest in how self-organizing and adaptive processes impact both artistic practice and viewer's experience. Hence, in *Vessels*, a genetic algorithm procedure is used to allow the robots to collectively converge to a common group behavior. A similar mechanism has been explored by Stephen Kelly – also a collaborator on *Vessels* – in his work *Open Ended Ensembles* (2016), where two agents use genetic programming (GP) to move along a fluorescent tube.

In my current research, I am interested in using machine learning as an approach to generate novel real-time processes which I refer to as *behaviors*. Following cybernetician Gordon Pask, I define a behavior as a stable form of events caused by an agent, as perceived by an external observer. [5, p. 18] I fit my own work within a larger artistic discipline which I call agent-based art, or "behavior aesthetics" – an expression coined by artist Simon Penny. which implies the performance of a synthetic agent as it unfolds temporally in the world through a situated artificial body [6, 398]. Such works are distinct from so-called "generative art" or "algorithmic art" which use computer algorithms to produce stabilized morphologies such as images, sound, and text.[1]

The work *for the sleepers in that quiet earth.* was created during my postdoctoral studies at The Trope Tank[5] at MIT in 2017, takes the form of an artbook, with a restricted number (31) of unique copies which each counts 642,746 characters – the same length as the version of *Wuthering Heights* that was used for training the neural network. Each copy is generated by a deep learning agent known as a long short term memory (LSTM) trained on the book by Emily Brontë. LSTMs – which are used in state-of-the-art language processing applications such as speech recognition and automated translation – are a kind of artificial neural network with recurrent connections, which are able to "learn" from sequences of data such as words and characters.

To produce the work, I first trained a LSTM on the complete text of *Wuthering Heights*[6] over many iterations. I saved snapshots of the agent at different steps of the learning process, from the beginning where it is initialized randomly, to the end where it has read the book 150 times. In particular, there are many changes happening in the agent during its first reading of the book; thus I saved 200 snapshots during this first run-through alone. These 351 snapshots – one in the starting state, 200 during the first epoch[7], and then 150 (one per epoch) for the rest of the process – were then used in a generative fashion to produce each version of the work: each snapshot was used to generate an approximately equal portion of the 642,746 characters of the book.

The result is a unique record of the agent as it reads the book and becomes more and more familiar with its syntax and style – and at the same time becomes more and more complex in its generative features. This unicity is important, because I see the work less as the trace of the agent's behavior than as a way to experience the behavior as if it was happening in real-time.

Like many other deep learning systems, LSTM agents are both predictive and generative. In most scientific applications, it is their predictive capabilities that people are interested in. For example, in machine translation, deep learning systems of the LSTM type are used for comparing the probability of different candidate translations and keep the one that is more likely.

Another unique feature of these systems is that, contrarily to other AI approaches, deep learning systems improve iteratively. Starting from nothing, as they become more and more exposed to data, they improve and become better at prediction – which also directly impacts their generative capabilities, if they have any.

These two ideas – generation and adaptation – form the basis of *for the sleepers in that quiet earth.* My intention in this work was not so much to produce an accurate "optimal" system that could generate rich, human-level, grammar-correct sentences. On the opposite, I seeked to allow the hesitant, strenuous learning process of the system to reveal itself as it goes through all of its sub-optimal states of being.

Another key conceptual dimension of the work resides in the ability of the agent to be both a reader and a writer. If we picture the text of *Wuthering Heights* as being the "world" in which the agent dwells and tries to make sense of by "reading" sequences of characters, then as it becomes more familiar with its environment, it is also able to "write" new possible sequences which can give an insight on the agent's understanding of its world. The performance trace of this agent is made concrete in the archetypal object of authorship par excellence: the book.

I made the decision to distribute this book only as a paper-based object, rather than in a digital version. This aspect of the work is crucial, as it lends a physical materiality to the agent and confers to it an identity beyond it's abstracted, virtual existence. As such, the artbook format contributes to the hybridity of the work, which in my view and intention lie between visual arts, electronic arts, and electronic literature.

[5] `http://nickm.com/trope_tank/`

[6] Some basic preprocessing was done to the text, as I explain later.

[7] In machine learning jargon, an epoch corresponds to one full iteration over the training dataset – in this case, the complete novel.

Morphogenesis

The behavior of the writing agent throughout the learning process manifests itself in a number of different ways, corresponding to the state of the agent as it becomes more and more atune to the "world" it lives in – that is, the text it is reading. As is traditionnally done, the neural network is initialized with random weights, representing a neutral state: at this point the agent has not been subjected to any observations and has thus no understanding of the world. Accordingly, in the first few pages of the book, the agent behaves completely randomly, as it has been initialized with random weights.

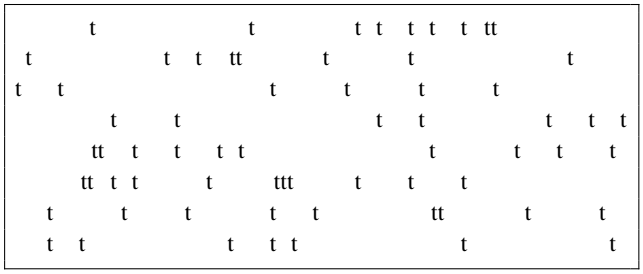
The agent then proceeds to read the book, one character at a time, in an attempt to build an internal representation of how character sequences are generated in Brontë's novel – in other words, by building a model of the author's style. In so doing, it learns more and more about the author's style as it reads, starting with building a comprehension of sequences at the character level and incrementally building from it to groups of two, three, four characters forming syllables, on to building words, and finally complete sentences.[8]

The following is a case study of a particular unpublished "reading" of the book, and thus construction of an LMST agent. Here is an excerpt of the first "sentence" generated by the agent in an unpublished version of the work:

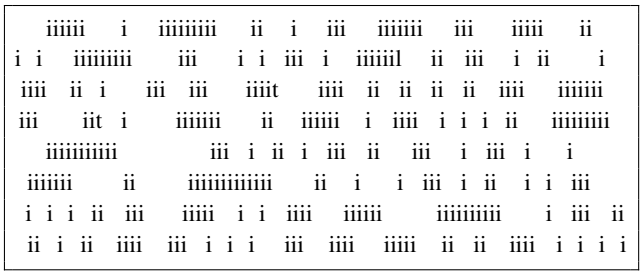
k:jnjw :: j :: lc ; jc ::: c : cnqnnn−−";x!khwwxwswvsvwvdxd'nx:
nc'i'"';'n'g;pg;pguunm−nmcovo:fow:wwwjdd:nden:':nn'nhk!
knhu?y?msy?yyywwowmww:fwfwwbdwdjfdnj,:jdzzr,lzrk−dqrk
"q−"k."−−".c"chhcixhcszzzx'

Excerpt at t=0

Early on in the training (after reading a few characters) the agent starts to utter erratically some of the characters it has seen:

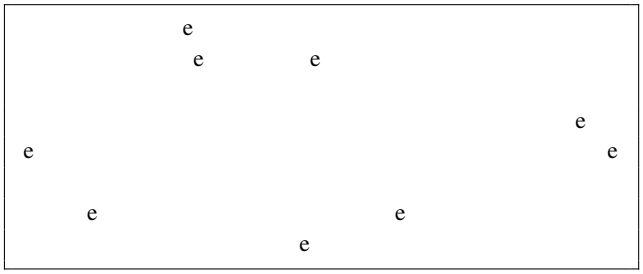


Excerpt at t=40



Excerpt at t=130

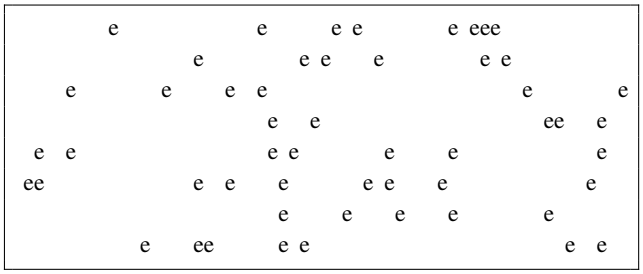
Later on, as it has seen more, it becomes obsessed with white spaces and frequent characters such as the letter "e".



Excerpt at t=530

These fixations can be explained through the probabilistic approach governing the system. More frequent characters simply have a higher probability of appearing in the text. For example, imagine yourself pointing to a random character in a book and trying to guess what it is without any context: you would likely have more chances of making the right guess if you chose a white space than any other character.

After reading a few hundred characters the letters produced by the neural net become more condensed and we see appearing some duplications of characters. These are the early steps of the agent moving from merely counting the frequency of characters as a predictive measurement.



Excerpt at t=1,810

The Glitch

Around having read about 5% of the book, the letters become more condensed and the agent even starts to tentatively concatenate frequent letters:

[8] In this paper, I describe the progress of the agent as it runs through the reading in terms of time. Here, time is to be understood in terms of character position. There are 642,746 individual characters in the original text. So for example, at time $t = 64,274$ the agent is about 10% into the book, and at time $t = 321,373$ it is halfway through.

t e e eea e e e a e a ee e e
ee a e e e e
e e e e e e a t
a e t ee e e e e
a e t e ee a e e a eae t ee e t
e e e e e a e e ee
e ne n a t e e e e n e aa
e e a a a ta e e t e

Excerpt at t=33,490

To my own surprize, not long after this point, the agent seems to regress to an earlier stage and starts behaving erratically for a while. I have not been able to replicate, let alone explain, the reasons of this glitch, despite several attempts.

jj jj : jj :: jjj : jjjj :: j : j e : :::: j : jj o
t : j :: j : j : o e e ee e t e
te e e o
e :! j jjjj :: jjj t jz
: j : jjj : jj : “j :: jj :: j” j : j :: jj : j :
jzjj :” jj a e t e a e
a “?j e e t t j
jj j :: jjjzjjjj o e jjzj a j : o

Excerpt at t=36,370

It soon becomes even worse:

“”“j” zjjjj ” jjj ”“”jj ”jj ”“ jjjjjjj ” jjejjjjj “”j”j” jjjz ”“”
jjjjj :j”: jjjjjj ”“jj t t ee t ee jj ee te
ee ea e””j : e “jj ”“j”j e t e e e ae :”jx :
jjjqjj :q”:” jjj ” jjjqjj : jjjjz ”jxj jj ”: jjz : jj “”“ jjjjj ” “: jj
” jjjxqj ”“”“”j : j ” jjj ” jjjjj ” jjje ”e tt i t e aejjjjjx
t e e t tt a jjj j e aa e e e ee
ea e tt e i j :”: jjjjxjj :”: j : z”“ “”“ jjjj ” jjjjjjxxxjjxj
”“:” jjjxjzj :”q” jqxjjj ”“j”j” jjjqjjjjj ”jx”jj jejj : zjjj : j

Excerpt at t=43,090

My best explanation is that this is due to an early attempt by the neural network to make sense of double-quotes (“”), which is one of the hardest mechanisms to understand for a neural network, as it involves looking backwards to a previous moment in the sequence – as opposed to learning about syllables which involve looking backwards to the one or two previous characters. The fact that the glitch happens around a position in the text where the agent encounters one of the first double-quote character, more specifically in the form of a quote inside a quote:

‘ “Maister Hindley!” shouted our chaplain. [...]’[2]

This, as well as the presence of tentative sequences of double-quotes in the next few learning steps, hint into that direction – although I was not able to verify it with certainty. Importantly, whereas I ran several training procedures in order to produce the work, tuning the model and the training procedure, this “glitch” only appeared in one of these experiments. Even a slight modification in the training data – for example, at some point I tried to remove the chapter titles – prevented the appearance of the glitch. Since I thought this was such a fascinating accident, I had no choice but to work with the specific experiment that produced it.

“”“”v””ovn”ob”o ojo ae e t ee ee aae e t e ee e e
e t tt ae e a :b””!b!!””v”!v”“ v e aei e e ett e
e ett ee t nt et et “ ja “”j!”bbb””!j”oj”ov”
bx e tte t tee ee ea eee e e e ta e ta”e
;”“”“”“”v””bj”j””x!j”“ t e ee ea e ee e e ne
“ eet aq!””b”vbv’oo ooonroooo e e eeea te atee
e e e e eaee eet i eete eivo”!boox xoee ei

Excerpt at t=44,050

Morphemes and Proto-Words

Not long after resolving the “glitch”, the agent eventually relaxes its generation of spaces. It seems to finally have learned one of the most basic principles of English language: the separation of groups of letters using individual spaces. From this point on, it starts to tentatively build morphemes of increased length separated by a single space. Sequences are first limited to series of one, two, or three of the most frequent characters.

oe e aa oe te o oo oe e e e iea ot e ae t ae oe iat e e e
oe to ie at ee e te e ee e e e oe ee t ee ee ae e o at ee
te a ee ie oe o te te e oe e ee e e ee e ea ie oe io ee e
te oa oe ta o oa se oe t te ae e ee e e ee oe e o oat o et
e ee e iae o see oe oo oe te t ae ae ee t o oe te e e ee
t e oe ie ia a te en a ao te e to e oe e ie ee ot t oe e
ea ee ie e oe e se a oe ee o te e oe t e a ea e e et ee t
e te a ot ae a e ae oe e ooe ae e a oe oe ioe e se tae e

Excerpt at t=59,410

Soon the agent starts combining more diverse groups of letters. We even start to see the appearance of short words.

he to toe site son ae tot te th aos tin thr tot to toe tot
to te tos his toot toe tit tot tat hoe tot te to hh te
ter tit hon se te toe hho io to tit te tin han tos hat tot
to tae tos ioe sos tan ioe hote ao tat iis tee to tat io
sot toe aote ho toe the tht tot tot tit tit thre ho toe th
his aot toe to toe toe hoe iho ton he tis te hot tot tis
toe aoe toe hhr te aot tos the th ais te ioe toe aoe to te
tos hos tot toe ton io hot tate ih toe hee ion hit tos te

Excerpt at t=113,170

anten a set tean an mor ander and ho sant and the mor
heatheren an thar an ter hand tor hir a tous hor tamle tor
hearh an ho anter and sos mhe merte and hoat he mam ho
anten a sise ter hat hean has and that in ser at an tou
sared an sorer at a tos tor marles the a sate hor mhan a
at the and samh hor i tor hashen and i samt i sore tor hor
a sor tor he mer tout af heus a mas a ther a and tor
heurt in a hase on the sote an has thor and the hor heur

Excerpt at t=184,850

This is shortly followed by early attempts to build short sequences of words, some of which are even correct English such as “in the”, “that is”, as well as “the mind” and “the mister”.

the sease and the his an the mind te at to seared the toul tout the tis and to to hhe mas is he the toun the i setened the the me the tor a sist hit you wos in sos in tis to ho the toat hat hhe seter the sor ind the in toe thas an the herare the tore the more a the the the mited i anserting the hor ho touthed in a tont to ceith to t he to mise it teat in the sorton in the tor the that that is seres of at ind an the sease the mister af the in se seret an tout the to the ind ander to se in seate sis the heathe i seited the sant i sind tho ceatter to the he inder the he

Excerpt at t=215,570

Punctuation and Sentences

After having read about a third of the book, the agent starts using punctuation. This excerpt contains the first usage of commas (,):

the heer to chered in at i son to sere the sorter , and ho merter the sorer the sand and his the meret ind the mored to me cered the coring in anter the mroned an the hor here the ceind the sere the sanding in the carter , and it i seind he mrer and so anter the the ter mererter to the

Excerpt at t=227,090

Periods start appearing sporadically, such as in this excerpt:

ind he andersed he he the her to he the sase of her he contered as he he hre hat the hand sore he her i here the mat sor and the porter at a sase to ansered . and i was the herper of the sose he haster and the her i chanded the handser he he hand the cand to the pandt he sortelling

Excerpt at t=280,850

At about two thirds through the book the agent is able to construct sentences of varying length, making syntactically appropriate use of periods, commas, and quotes. These sentences are mostly nonsensical and grammatically imperfect. Yet, they seem to mirror some of the core aspects of the original text, including the use of the first person's voice; the abundance of dialogs; and the construction of long sentences with many complementary clauses as is common in 19th century English literature. Above all, it is the rythmical qualities of the text produced by the artificial agent that bears the most resemblance to Brontë's style.

'so satherine. he deat i could to she laster it the sranes and the door his sathered. 'i his lestanded to srean and hime wall at and the lister and santion.'

'you have wor trearing her an the care, and the look. i was so deat to the litter to see it i chould her a lested and to his fore the deand to her and to sathering to see the lounder her her seed to the reanten, his for had so the roster on a sould be the lose, and the had ase a meter to the leas on a mate a merared of his for shanted to me to sear the lease the dade and aspering his to sere and then i meath. i wall not he couse in the heas of the laster of him to her to mishers. i was not hear he so sann the linton his her the fide the rase her his couster the srarged a sranted the had sarle the has the loor.'

Excerpt at t=448,530

As a point of comparison, consider this excerpt from Chapter VIII of *Wuthering Heights*:

> 'I guess she is; yet she looks bravely,' replied the girl, 'and she talks as if she thought of living to see it grow a man. She's out of her head for joy, it's such a beauty! If I were her I'm certain I should not die: I should get better at the bare sight of it, in spite of Kenneth. I was fairly mad at him. Dame Archer brought the cherub down to master, in the house, and his face just began to light up, when the old croaker steps forward, and says he—"Earnshaw, it's a blessing your wife has been spared to leave you this son. When she came, I felt convinced we shouldn't keep her long; and now, I must tell you, the winter will probably finish her. Don't take on, and fret about it too much: it can't be helped. And besides, you should have known better than to choose such a rush of a lass!"' [2]

Improvements

This is an excerpt after one epoch of training – that is, after the agent has read the book once. At this point the agent has learned to generate complete sentences, with a few glitches. Many of these sentences are still grammatically incorrect and somewhat random. It is as if the agent can only "see" two or three words in the past, with usually only short sequences of two or three words making logical sense together. Consider for example the progression in the following sentence generated after the first epoch:

i dade the cornert of her and, and he sheat it it with the deant a sood of the housh he had sather to him, and i had not the haston, and she had a contred to her to the sattle to the conder of his so stoul him the did or the seen.

Excerpt at epoch 1

From this point forward, the neural network is trained for several epochs, having re-read the novel up to 150 times. Changes in the agent's outputs become less perceptible over these later iterations. The first epoch allowed the agent to grow from pure randomness to building morphemes, words, and full sentences with punctuation marks. In the following iterations over the novel, the agent seems to expand these basic building blocks by (1) polishing grammar;

(2) expanding vocabulary; and (3) diversifying the lengths and structures of sentences – including producing dialogic constructs which are common in the original text.

To get a sense of this evolution, here are some sample sentences from epochs 5, 20, 80, and 150, which may give a sense of the transformation in the agent's behavior.

> he was a sure that i should never tell me to her heart in the same on the grange and countenance and could not be a strange of my little constant to bear him a chorg and companion and sure the sits that i was a sudden and sense of a moon of the door; i supposed me to receive the subject of a place to his father's any range.

Excerpt at epoch 5

> 'you have the delight is to spend them to speak to be a single things!'
>
> 'it was a grief of more truth, and the satisfaction which i was a bad contents and the house for me, and struck her features with me to the servant to and a mean and startling. he would be a state that is the case. i don't like that i shall be the door, i dare you?'

Excerpt at epoch 20

> 'were you hear the plant of his father's sort of morning? what do you stay it to my hands to me! i'm not married and desire to be always there, and you would send it out of the farm. i hope you had been hardly to have a foold at all. i can be all start and talking a minute in his senses. when i asked if i was no far which she should be sure from the house, and i could not be silent on the fire, and hid her little abode on the heights, and i have a solret associations,' interpupted stared; 'i'm nearly to do you to send them,' said the strength.

Excerpt at epoch 80

> 'they would not resign you to the danger over through to me!'
>
> 'he's both a books then,' he added, sufficiently.
>
> 'who is them insolently−spaking to him,' said catherine. 'you are a seat,' he said: 'i don't might wark his stall in that third that they are.'

Excerpt at epoch 150

Practical Considerations

This work follows up from my previous research on adaptive systems. My robotic work *Vessels* (2015) mentionned before involves groups of water-based robots react to their environment and with one another by evolving a group behavior which is realized using genetic algorithms. In *N-Polytope: Behaviors in Light and Sound After Iannis Xenakis*[9] (2012) I designed different kinds of adaptive behavioral patterns actuated through sound and light using self-organizing integrate-and-fire neural nets, reinforcement learning, and genetic algorithms.

[9]Directed by Chris Salter.

for the sleepers in that quiet earth. was sparked by an interest in working with deep learning neural networks. Such systems are now widely used in natural language processing (NLP) applications. In any computer-based work, there is a tension between authorship and autonomy. As in my preference as an artist, I chose to leave as much space as possible for the system to act independently. Yet, I had to make some choices to facilitate the agent's performance. These choices are described hereby.

Preprocessing

Wuthering Heights contains a little more than 600,000 characters, which is rather low when compared to state-of-the-art language modelling datasets which usually contain several millions of characters.[10] Starting with an open-access version of *Wuthering Heights* [2] I slightly reduced the complexity of the learning task by reducing the number of different characters encountered through (1) turning all letters to lowercase (so that the agent does not need to distinguish between uppercase and lowercase letters); and (2) remove low-frequency characters such as parenthesis – which appeared only a few times in the text and would only confuse the agent.

Training

The way the neural network is being trained can help understand how it behaves. The network attempts to model the distribution of patterns in the text. It does so by estimating the conditional probability of the next character x_t given the past N characters $x_{t-N} \cdots x_{t-1}$:

$$P(x_t|x_{t-N} \cdots x_{t-1})$$

This probability distribution is represented as a very complex function that produces one probability value for each possible character. For example, let's say that $N = 10$ and that the 10 previous characters seen by the agent are "wutherin"; then after training we would expect the agent to emit a high probability $P(g|wutherin)$ for the letter *g* (wuthering), a lower probability $P('|wutherin)$ for a single quote (') (wutherin'), and near-zero probabilities for every other character.

The network can then be used to generate new sequences, simply by sampling randomly using the distribution and repeating the procedure. To get back to our previous example, after choosing the letter *g*, the agent would sample a new character, this time using the input "uthering" – in which case we would likely expect high probabilities for *s*, a white space (_), and other punctuation marks (*.,?!*).

This kind of statistical approach which looks at the previous N units in a sequence is known as a markovian process. Markovian processes are very common in natural language processing.[4] One of their limitations is that they make the assumption that the closest elements in the past are the most important to predict the future, which is an imperfect premisse to say the least – especially when it comes to lan-

[10]As a point of comparison, consider the difficulty it would represent to learn how to write a book in an language unknown to you, with the only information being a single book written in said language.

guage where there are often very long-term dependencies. This explains to a large extent why the sentences generated by the agent, even in the later stages of training, are somehow detached from one another, as the neural network fails to grasp long-term dependencies between sentences.

To model that probability distribution, I used a LSTM network with two layers of fully interconnected hidden units with 200 neurons each. Input streams were sent by chunks of 100 characters using a sliding window ($N = 100$). Input characters were represented using embeddings, a technique where each symbol is represented by a vector which is itself trained. For example, in this work, I used embeddings of size 5, which means that each character is represented by 5 different values. These values can be seen as a representation of different characteristics of each character that can be useful for the system to make better predictions over sequences. For example, the first value might represent whether the letter is a vowel, the second value whether it is a punctuation mark, etc.[11][12]

The total number of free parameters – i.e., the "weights" or "synapses" in the neural network that will be adjusted during training to make the network perform better over time – in the architecture is 493,222, which is almost as high as the size of the database – that is, the number of characters in the book. This suggests that the system is likely to overfit[13] as it is trained. Overfitting is a dreaded problem in machine learning, as it prevents the system from getting good generalizations: as the system becomes too much attuned to the training set and starts remembering it "by heart", so to speak, its performance drops when subjected to new examples. However, in this project, I purposefully chose a high number in order to give enough power to the system to learn to produce interesting and diverse results – an example where scientific and artistic objectives diverge.

Generating

After the training, I thus obtained a series of probability distributions at different stages of the evolution of the model, which were then used to generate each book. After some experiments, I noticed that the probability ditributions in the early stages were too much "spread" accross the characters (i.e., there were not too much differences between each probability) and that the agent would thus generate text that appeared "too random" to my own taste. I thus decided to slightly adjust the probability distribution to make it more "peaky" by increasing the probabilities of the most probable elements and decreasing the probability of the others.

However, this approach seemed too "greedy" in later stages where the agent would become complex enough to be able to consider different sequence construction and completion. Thus, as the agent became more and more trained, I adjusted the probability distribution to be more "spread-out" to encourage diversity.[14]

Still, since no character ever had a zero probability, there were always cases were the agent would accidentally generate a completely arbitrary character. In order to limit this phenomenon while allowing variety, I forced the agent to choose among only the top 5 most probable characters.

Postprocessing

Finally, through discussions with my editor Nick Montfort, we decided to implement a few minor changes to bring the raw generated text into book format. For instance, we interpreted the appearance of the word "chapter" followed by roman letters in the generative text (eg. "chapter xix")[15] as an indication of a new chapter, which we thus formatted differently with a page break and bold typeface.

Discussion

for the sleepers in that quiet earth. is a hybrid work that borrows from different art and engineering traditions and practices. The generated text is far from being "good" and "optimal". So in that sense it does not fit within the canon of electronic literature. We do not seek here to create something that holds together in terms of English writing. On the contrary, the imperfection of the generative system's "voice" is perhaps the primary content of this work. *for the sleepers* is not an attempt in passing the Turing test of literacy, nor in creating an artificial clone of Emily Brontë. What this work affords is not so much the imitation of a style – because the agent never reaches that point – but rather, what is put forward is *the learning process itself*.

It is precisely in this sense that *for the sleepers in that quiet earth.* does not constitute a work of generative electronic literature in the traditional sense, as here the "trace" of the behavior is not differentiable from the behavior itself as the agent proceeds to evolve in its "world" delimited by the character sequences of Brontë's novel.

Through its liminality, *for the sleepers* opens a space for understanding and reinventing concepts and ideas about agents, behaviors, and deep learning. How do behaviors of adaptive systems differ from those of non-adaptive systems? What distinguishes a behavior from the trace it leaves? Does a behavior require the real-time, embodied presence of the agent that generates it?

In my past work, I have established a distinction between different categories of behaviors.[1, 7] I have referred to simple stateless mappings as nonbehaviors (or zeroth-order behaviors). Rule-based, formal systems such as those designed using traditional programming using conditions and loops produce first-order behaviors: given enough time, a perceiving entity with sufficient intellectual capacity can theoretically infer the rules that govern the actions of the

[11] In reality, we rarely see such human-based categories appear in embeddings, as the system finds its own way to represent information which is often counter-intuitive as we do not "think" like an artificial neural network does.

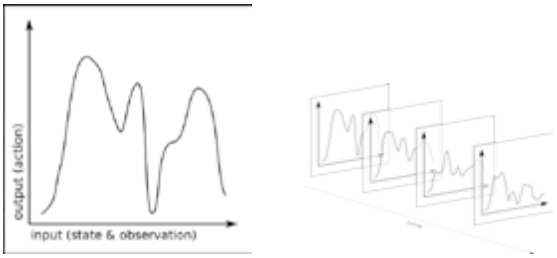
[12] The code for the system is available here: https://github.com/sofian/readings.

[13] Overfitting is a common problem in machine learning where a learning system with too much "power" (too many parameters) is trained on a database that is relatively too small. The result is that the learning system will use this power to memorize the dataset "by hearth", which will reduce its capacity to generalize its learning to new examples outside of the training data.

[14] The probability distribution is represented by a function which comprises a parameter $\tau \in [0, \inf]$ called the *temperature* which is typically set to 1. Raising the temperature spreads out the probabilities, making them more uniform, while lowering it makes the distribution peakier, hence making the agent even more greedy to choose the letter with highest probability.

[15] Notice that these appear randomly. For example, "chapter xi" might appear before "chapter iii".

agent. Following this framework, I argue that the reader who flips through the pages of *for the sleepers in that quiet earth.* observes a second-order behavior (or metabehavior); that is, a behavior that change through time according to another behavior. This kind of behavior is characteristic of self-organizing systems such as neural networks and genetic algorithms.



(a) First-order behaviors: Rule-based systems react to the world in a way that is more or less stable through time.

(b) Second-order behaviors: Adaptive and evolutionary agents modify their behavior in reaction to observations.

Fig. 1: Representation of behaviors in nonadaptive vs adaptive agents. This figure compares the response of formal systems with that of adaptive and evolutionary systems. The relationship between inputs (i.e., what the agent observes as well as its current state/memory) and outputs (ie., the actions taken by the agent) of a formal system is temporally invariant, whereas adaptive and evolutionary systems allow it to change through time.

Under which conditions does the experience of perceiving a past behavior through the trace left by an agent can be considered an experience of behavior aesthetics in itself? Here it is implied that the time in which the artificial agent evolves is distinct from human time, and that the agent lives in a very different world than the reader's. Whereas human observers have already acquired a sense of words and sequences – and attribute meaning to such sequences – the world in which the LSTM agent evolves is constituted of chains of arbitrary symbols which the system discovers sequentially. By reading the book we are thus seeing an outlandish form of acquiring language. There is therefore a disruption between these two experiences. Yet, human viewers possess the observational capacity to identify language structures (morphemes, words, sentences) that speak to us, on which we project meaning. As in the tradition of many other agent-based artistic approaches such as artificial life and robotic art, the art object instigates a process of projection and/or evocation, where the viewer attributes some form of agency to the system. As I hope to have demonstrated in this paper through a close look at the generative text process, beyond the immediate appreciation of lexical components and indeterminate literary "gems", the reading of the book reveals the ghostly presence of an artificial entity.

for the sleepers in that quiet earth. thus challenges concepts of "algorithmic art" and "behavior aesthetics". In effect, it presents itself as a stabilized object containing the trace of a computational system, and in this sense is akin to other computer-based generative artworks such as computational poetry, algorithmic music, and generative painting. While the work clearly differs from more "traditional" forms of agent-based art and behavior aesthetics such as works of artificial life and robotic art, since what is given to view to the reader's eyes is the behavior of an agent, and since the work is primarily about that behavior, I argue that it differs from other such generative artworks that attempt to produce stabilized media form using a process; in that this work's core subject and materiality is precisely the behavior of the system that generates it.

Conclusion

for the sleepers in that quiet earth. is a hybrid project that spans diverse approaches such as electronic literature, generative art, and behavior aesthetics. It uses a deep learning recurrent neural network, not so much as a way to generate novel and creative writing by taking advantage of the system's ability to imitate human performance, but in an effort to reveal the learning process of the system. In other words, it subverts the purpose of artificial intelligence, which aims at reproducing or exceeding human performance – in this case, by imitating the style of a well-known English author – and instead brings the focus back to the behavior of the artificial agent as it tentatively tries to achieve its goals.

As thus, rather than focusing on the kind of literary prowesses such computational systems are able to do, *for the sleepers* offers the reader a unique insight into the inner workings of a machine learning algorithm by turning the experience of reading into an encounter with a behavior. The hybridity of the artwork asks questions about its ontological position, emphasizing distinctions between generative art and behavior aesthetics. While the work is certainly different in many respects from works traditionally understood as agent-based artworks such as those employing situated robotic systems, it shares with them a unique focus on the behavior of an agent – in this case, by allowing the observer to experience the phantom journey of an artificial machine learning agent.

Acknowledgments

I would like to thank the Fonds de Recherche du Québec - Société et Culture, the Massachusetts Institute of Technology, The Trope Tank, Bad Quattro, and Dr Nick Montfort for their support.

References

1. Audry, S. 2016. Aesthetics of Adaptive Behaviors in Agent-based Art. In *Proceedings of the 22nd International Symposium on Electronic Art*.

2. Brontë, E. 1996. *Wuthering Heights*.

3. Hochreiter, S., and Schmidhuber, J. 1997. Long Short-Term Memory. *Neural Computation* 9(8):1735–1780.

4. Manning, C. D., and Schütze, H. 1999. *Foundations of Statistical Natural Language Processing*. Cambridge, Mass: The MIT Press, 1 edition edition.

5. Pask, G. 1968. *An Approach to Cybernetics*. London: Hutchinson.

6. Penny, S. 2000. Agents as Artworks and Agent Design as Artistic Practice. In Dautenhahn, K., ed., *Advances in Consciousness Research*, volume 19. Amsterdam: John Benjamins Publishing Company. 395–414.

7. Senécal, J.-S. 2016. *Machines That Learn: Aesthetics of Adaptive Behaviors in Agent-Based Art*. Phd, Concordia University.

Virtual Reality as a medium of abstraction. The "Stilleben" project.

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Abstract

The article is devoted to the presentation of the project carried out at the *Ubu Lab* at the Jagiellonian University in Krakow, Poland. The work titled *the Stilleben* is a minimalist, interactive experiment in the field of human-computer interaction as well as the translation of work done with classic graphic techniques into the virtual spaces.

Keywords

Virtual reality, art, abstraction, graphic design, HCI, minimalism.

Introduction

In the past few years, Virtual Reality (VR) has become an entirely recognized medium of art. Currently, the efforts of artists and experimenters are focused on the exploration of idiomatic expressive means characteristic for this technology. The subject of this article is the presentation of a concept related to the transfer of two-dimensional graphic expression to the 3D environment (exhibition in "real life"), and later into the space of an immersive interactive medium (VR experience). The critical problem that had to be solved when transferring a 2D graphical work into a virtual space was to preserve the original overtones of the work: focus on abstraction, minimizing the means of expression. Discussed work is supposed to be a counterbalance to currently popular, claptrap, blown-out multimedia presentations. Presented project - *the Stilleben* asks the question of the possibility of a minimalist, somewhat meditative experience in such a sensory, intemperate medium as VR.

The Stilleben

The Stilleben project is a collective work of Jakub Woynarowski and Jan K. Argasiński, the members of the group of polish researchers, artists and programmers affiliated with the *Ubu Laboratory* at the Jagiellonian University in Krakow, Poland who focus their investigations on creative computing and platform studies. They also study ways for curating, presentation and preservation of such works.

The key notion for many visual quests of Jakub Woynarowski – the author of *Stilleben's* artistic concept – is abstraction, in its broad sense. He is interested in the images of objects that are taken to the level of abstract symbols, yet the degree of their figurativeness is determined by ever-changing context. It is quite well exemplified by his project *Hikikomori* created in 2007, which was the main inspiration for *Stilleben*.

The word "hikikomori" (meaning "internal confinement" or "isolated entity") is used to describe a condition widespread among young people in Japan. The state has a psychological-emotional origin and results in people isolating themselves from the world, not leaving their rooms, which they treat as fortresses, inaccessible even to their closest relatives. Woynarowski's graphic short story inspired by it, may be treated as a metaphorical record of subsequent stages of deterioration of the human mind. In 2015 he created three-dimensional adaptation of the story, presented during the *Think Tank Lab Triennial* in Wrocław. The labyrinthine narration of the exhibition, based on drawings, objects and projections, develops without any words or presence of living "heroes".

Figure 1. *Hikikomori* 2012 installation in the Museum of Contemprorary art in Krakow (MOCAK)

The author of *Hikikomori* attempts to create a sort of visual alphabet based on everyday objects that were devoid of reality. While searching for some stimulating analogies between them, their forms were "rounded off" to extract their abstractive potential out of the realistic, instructional drawings. Due to their excessive synthesis, quasi-objective technical illustrations became ambiguous and evolved into non-objective art. An illustrative example could be a print showing a black circle, which actually could be a depiction of anything – a shadow, a hole, or a liquid stain. In the structure of the whole elaborate visual essay these discrete elements

became letters that could be arranged in various configurations to freely make up various words.

Figure 2. J. Woynarowski, *Hikikomori,* album p.8

Jakub Woynarowski developed this language of semi-abstract signs in his experimental visual narratives, whose forms resemble visual essays, atlases or graphic novels. Usually he doesn't portray a human figure, focusing only on objects that belong to him. The leitmotif of these projects are the three basic geometric shapes: triangle, square and circle.

The continuation of *Hikikomori* was the *Vernalin* project (2011), focused on the relation between animate and inanimate matter. The project is inspired by Stanisław Lem's short story *Darkness and Mould* and also by scientific theories about vernalin - a hypothetical plant growth substance that, it has been suggested, is formed in meristematic regions of a plant subjected to cold.

In the post-human graphic novel, *The Dead Season* (2014), based on writings of Bruno Schulz, Woynarowski presented an utopian world, which, in the absence of humans, is ruled by objects, plants and little creatures. This uninhabited space, frozen in the 80's, reminds us of Pripyat, abandoned city in the zone of alienation, established after the Chernobyl disaster; the red color of plants (supplementing black & white drawings) is similar to the Red Forest, which turned ginger brown as a result of the radiation. The only inhabitants of this area – overgrown with plants (in which we can observe subtle physical abnormalities) – seem to be multiple insects, appearing in the garden, but also in the flat, accelerating the process of human world's deconstruction.

Stilleben is the next step on this path of development. It consists of two parallel yet interconnected visual stories. One of them is contained in the Augmented Reality (AR) art book, which could serve as "operating manual" of brand new visual language. The second version of the story is presented in the form of VR interactive installation, which can be seen as a form of exploratory game or non-linear visual poem.

Its idea was inspired by 17th century still life paintings (in german: "Stilleben"), depicting mostly inanimate subject matter, in which the state of 'death' reveals also to be a kind of 'silent life'. In fact, many of these compositions were allegorical visual essays, which could be compared with early modern cabinets of curiosities – encyclopedic collections of objects, regarded as memory theaters or microscopic reproductions of the world, which could be treated also as a prototypes of a contemporary art galleries. The word "cabinet" can be understood in two ways: as a room, a unique environment in which the various elements that make up the collection become integrated into an organic whole, or as an object, a piece of furniture, associated with Duchamp's *Green Box* or Breton's "poem-objects". Some of these cabinets, enclosed in the form of fine furniture, bring modern computers to mind. A good example would be a piece of furniture commissioned in the 17th century by Philipp Hainhofer, which was equipped with all the functions found in a modern computer, such as a catalogue system, writing and music playing applications, or even a variety of games. This parallel could be taken to a further step – quite a few researchers have pointed to the similarities between contemporary internet blogs and curio cabinets.

This kind of multilayered storytelling is apparently founded on "cosmological" way of thinking, present also in two significant examples of early modern synthetic visual "hexamerons", which describe God's work on the six days of creation: Michael Wolgemut's Genesis sequence for *The Nuremberg Chronicle* and Matthaus Merian's illustrations for Robert Fludd's treatise *Utriusque cosmi... historia*. In both cases, we encounter a presentation of the Genesis creation myth in a form that could be described as a semi-abstract comic strip, a sequence of images circumscribed around the figure of a circle. The first drawing in Robert Fludd's cycle presents the original chaos and it is nothing but a black square, captioned with a formula "Et sic in infinitum" (And so on to infinity).

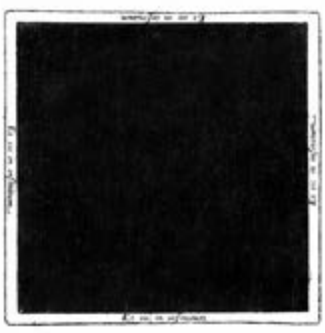


Figure 3. R. Fludd, *Utriusque cosmi... historia*, Oppenheim 1617

This print, created in 1617 is deceptively similar to Malevich's Black Square on White Ground. It's possible to compare these works with another examples of "cosmological" visual stories created in the 20th century (mostly based on architectonic metaphors), such as El Lissitzky's *A Suprematist Tale of Two Squares in Six Constructions*. According to Odile Belkeddar, the author of introductory note to Lissitzky's book: "Transformed into a visual object, the book is constructed as a building in which volume and movement are represented. As a designer of exhibitions, El Lissitzky would even use walls, floor and ceiling, like six faces of a cube". Very similar intuition was expressed by Paul Gravett, who described British narrative *PoCom-UK-001* as the interference between contemporary hyper comics and gallery comics: "The originators' ambition, still to be realised, is to extend PoCom around another three walls of the gallery and then connect panels with further stories across the floor and ceiling, and cutting diagonally across the gallery space, to burst out beyond this cube to create a blossoming organic nest of stories, achievable only in virtual space" (Gravett 2013, p.132).

Such transgressive strategies were also developed by American alternative comics' scene, especially in the circle of the *RAW* magazine, edited by Art Spiegelman – the author of such graphic novels as *Maus* and *In the Shadow of No Towers*. It's worth to compare two artists coming from this circle, focused on "paradigmatic" way of thinking and non-linear visual storytelling: Richard McGuire and Chris Ware. McGuire's *Here* and Ware's *Building Stories* are hypertext visual stories focused on the architectonical form of building as a starting point for narrative experiments. Another, similar example of "architectonical" and "cosmological" storytelling could be the "reduction" of Marcel Proust's *In Search of Lost Time* by François Ayroles, a member of OuBaPo (short for French: "Ouvroir de bande dessinée potentielle"; roughly translated: "workshop of potential comic book art"), French experimental comics movement (styled after literary movement OuLiPo) which uses formal constraints to push the boundaries of the medium. These seemingly unusual projects can be seen as a part of wider group of "stories without characters", represented by *The Cage* by Martin Vaughn-James, *SPUK* by Niklaus Rüegg and *Rumble Strip: If You Want to Get Away with Murder, Buy a Car* by Woodrow Phoenix.

The whole multilayered narrative of *Stilleben* refers to the tradition of visual "hexamerons", depicting the stages of Genesis process. The gallery-like white cube space can be seen as a reference to The Cube of Space - an occult concept that was popularized by Paul Foster Case. It associates the three axes, the center point, the six sides and the twelve edges of the cube, with the 22 letters of the hebrew alphabet. The Cube of Space is based upon the verses of the proto-cabbala text called the Sepher Yetzirah, which describes directly the Genesis process. Similar concept was also introduced by Jay David Bolter in his book *Writing Space: Computers, Hypertext, and the Remediation of Print*, where the alchemical and cabalistic codes are compared with contemporary digital interfaces.

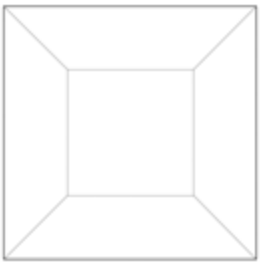


Figure 4. *Stilleben* VR application: the initial state.

This kind of procedure could also describe very well the way how the user of *Stilleben* opens up new chapters of the story, following semi-abstract icons placed inside the white cube. The process of communication is repeatedly interrupted by rebellious black matter – this strategy is present also in two early examples of "interactive" literature: *The Life and Opinions of Tristram Shandy, Gentleman*, a novel by Laurence Sterne (full of narrative "blackouts") and Gustave Doré's graphic book *History of Holy Russia* (where the abstract ink blots take over the pages of historical treatise).

In *Stilleben's* sterile and claustrophobic space, a mysterious "para-matter" sets ordinary objects in motion, causing their spectacular deconstruction in the course of time. The white color of the walls, fabrics and electrical appliances may be associated with the illusory peace and quiet of a home, but they become black in the final stage of the story, annexing the spaces which follow. The appearance of danger in a "tamed" space implies a certain conventionality of the territory delineated by humans, constituting both an asylum and prison.

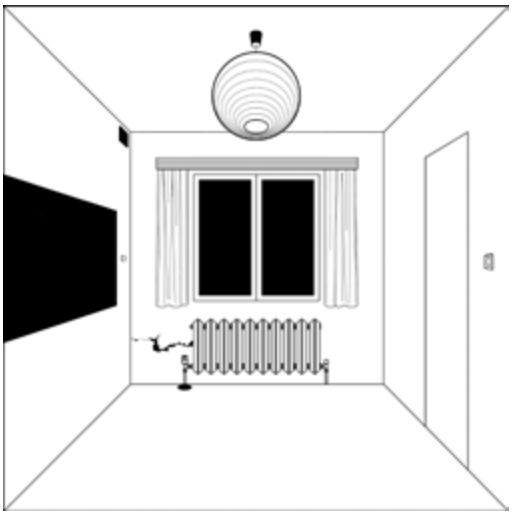
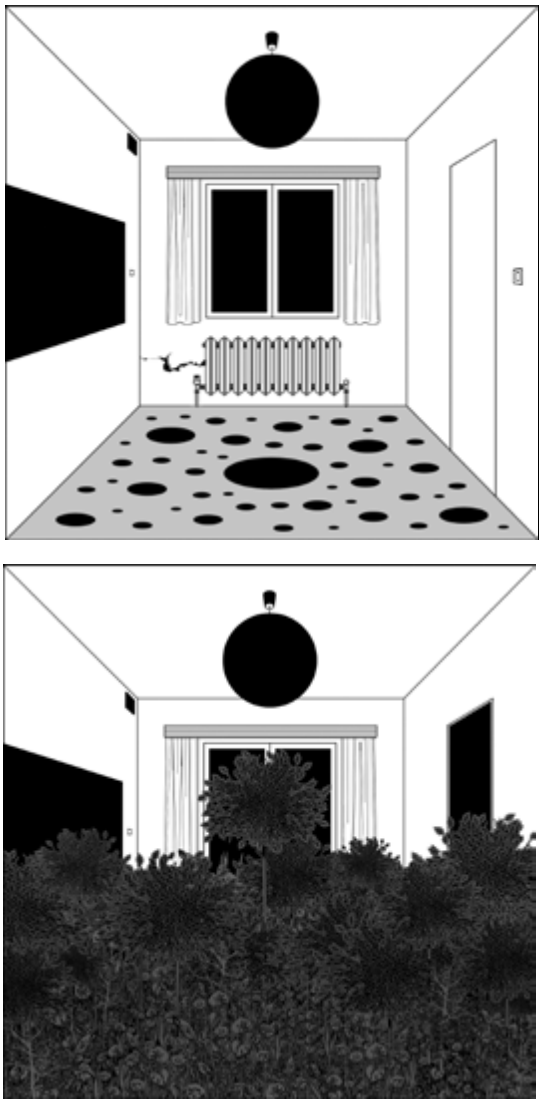


Figure 5. *Stilleben* VR application: "black para-matter" invades.

That's how modernist „machine for living in" (as stated by Le Corbusier in his 1927 manifesto *Towards an Architecture*) becomes an uncanny cabinet of curiosities. It's important to highlight the etymological connection between the idea of "uncanniness" and "home" as a secure human's habitat. This concept was probably first fixed by Sigmund Freud in his 1919 essay *Das Unheimliche* (German word "Heim" is for "home"). According to him the uncanny is the psychological experience of something as "strangely familiar", which expresses unconscious, repressed impulses

In *Stilleben* the oppositions seem to be interconnected. Even the Genesis and Apocalypse are closely linked: finally, through the dynamic metamorphosis an empty white cube becomes a luxuriant garden. The story of *Stilleben* is also a universal tale of the passage of energy and impermanence of forms, which disintegrate and keep reviving in new shapes.



Figures 6 and 7. *Stilleben* VR application: invasion of "black mater", white cube becomes a luxuriant garden.

The technology of *Stilleben*

The implementation of the presented project has three components: a) physical space of action, b) computing hardware (inc. VR headset) and c) software application.

Ad a) For the *Stilleben* VR "exposition" the dedicated room was built inside *Ubu Laboratory* at the Jagiellonian University in Krakow, Poland. The room is the exact equivalent of the white Cube of Space - the basic, sterile and claustrophobic place depicted on the before presented storyboards. The physical space of the experience is precisely matched in dimension with the virtual one. This means that if a user encounters a wall in virtual space - he will also encounter it in the real world. The room is closed, and the doors are in the same place "in both dimensions". This allows for the creation of a real sense of isolation, which is crucial for the designed experience. In the room, apart from that, there is only virtual reality equipment, which is hanged at the ceiling on a flexible cable.

Ad. b) Computing hardware includes state of the art PC located outside of the "VR box" and HTC Vive with two Lighthouse Trackers (base stations) and two controllers.

Ad. c) VR software was developed in Unity engine (C# programming language) using VRTK – *Virtual Reality Toolkit* package from Asset Store. Application allows for free movement in virtual space and for interactions with objects (including physics of objects).

Current status and future development

The *Stilleben* prototype is currently available for use at *Ubu Lab* in Krakow, Poland. Future plans include publishing detailed technical report on the work.

Described piece is the study in minimal, experimental design in Virtual Reality. The next step includes application of Augmented Reality to merge classical graphical medium (artbook, graphics exhibition) with the computational one. The new application as well as "portable" version of VR experience will be ready for presentation before june 2018.

References

Bolter, J. D. (2001). *Writing Space: Computers, Hypertext and the Remediation of Print. Second Edition.* Mahwah.

Dore, G. (2017) *The Rare and Extraordinary History of Holy Russia*. Pallas Athene Arts, London.

Fludd, R. (1617-24) *Utriusque Cosmi ... metaphysica, physica atque technica Historia,* &c., Oppenheim and Frankfort.

Goodbrey, D. M. (2012). *From Comic to Hypercomic*, *Retrieved from* http://www.inter-disciplinary.net/at-the-interface/wp-content/uploads/2012/09/Danielgoodbrey_finalpaper.pdf
Gravett, P. (2013). *Comics art*. London.
Lissitzky, E. (2014). *A Suprematist Tale of Two Squares in Six Constructions*. London.
McCloud, S. (2000) *Reinventing Comics*. New York.
McGuire, R. (2014) *Here*. New York.
Molotiu, A. (2009). *Abstract Comics: The Anthology*, Washington.
OuBaPo. (1996). *OuPus 1*, Paris.
Phoenix, W. (2008). *Rumble Strip: If You Want to Get Away with Murder, Buy a Car*. Brighton.
Rüegg, N. (2004), *SPUK*, Zürich
Ware, Ch. (2012). *Building Stories*. London.
Vaughn-James, M. (2013). *The Cage*. Toronto.
Grau, O., (2003). *Virtual Art. From Illusion to Immersion.* MIT Press, Cambridge MA
Kac, E. (Ed.) (2007) *Signs of Life. Bio Art and Beyond.* MIT Press, Cambridge MA
Kwon, M. (2002) *One Place After Another. Site-specific Art and Locational Identity,* MIT Press, Cambridge MA
Linowes, J. (2015). *Unity Virtual Reality Projects.* Pactk Publishing, Birmingham

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Acknowledgments

The Stilleben is part of *Creative Computing. The laboratory (Twórcze programowanie. Laboratorium)* K/PMI/000260 National Programme for the Development of Humanities grant funded by the Polish Ministry of Science and Higher Education.

The Institute for Interanimation: A Framework for New Media Collaboration

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Abstract

This paper reflects on an experiment in new media art and pedagogy that combined technical research with creative output through a collaborative large-scale project. Developed at the University of Virginia, the Institute for Interanimation provided a framework for faculty, students, and local artists to collectively build an audiovisual environment called *Phase 3*, exploring how new technologies continually reframe what it means to be (a)live. Virtual reality pods, interactive objects, and live animations examined the social and cultural implications of mediation, virtuality, and liveness across hybrid physical/digital spaces. Outlining a conceptual and practical framework for collaboration, the authors discuss the shifting objectives of the Institute for Interanimation, an organization dedicated to exploring the unpredictable and continually shifting thresholds between 'real' life and 'virtual' life. This paper seeks to present a few frames culled from a much longer animation. It outlines a multifaceted and practical approach to new media pedagogy that moves between the technical and the critical, the classroom and the stage, the live and the live. The intention is to share an attempt at developing an institutional structure based on change rather than permanence without shying away from tensions and complications that emerged within the process.

Keywords

art, interactive systems, collaboration, new media, media installation, responsive environment, audio/visual systems, art and technology, live performance, audience experience

Phase 3: A Walkthrough

You enter the black box theater and pass through a small room where you are greeted by a glowing round fur covered light—ii—both organic and electronic (Figure 1). One of the i's is mirrored and together the serif i's forms a strange u, also eyeballs. You hear music, a shifting synthetic wash, not loud, you continue.

Through the inner door, you find yourself in another chamber. It is dark save for a grid of 20 head-like forms that slowly warp and morph under shifting projected light (Figure 2). You continue through an opening in the curtain and find yourself in *Phase 3*, an installation developed and designed by the Institute for Interanimation.

There are various glowing systems arranged in a large circle. The systems are human-sized and slowly animating—blinking, swinging, talking, spinning—they ask you to join them. Some of their scripts are clear—"turn this dial" or, "pluck these strings," but some of the systems seem ambiguous or unresponsive. You watch for a bit (Figure 3).

Figure 1. Entrance Light

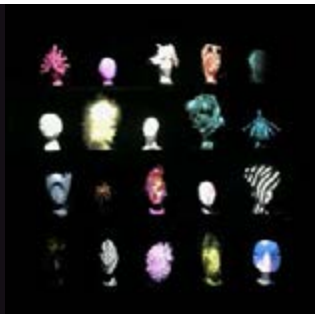

Figure 2. Grid of Heads

Figure 3. *Phase 3*, The System. © The Institute for Interanimation

Other guests are moving around, playing and performing in the space. The ambient soundscape shifts suddenly, diving down and settling into a lower, slightly ominous drone. You walk around the main area and pick up a glowing fur covered object near a screen in the corner of the room. It turns out to be a live camera and, with an active feed in hand, you start to explore the space, sending your perspective back to the screen (Figures 4 and 5).

You watch as electro-mechanical mechanisms click and clack for seemingly no reason. "Is it tracking my movement?" you ask another guest. "No!" a child corrects you, "see those tentacles over on the other side? If you shake them, this thing wakes up!"


Figures 4 and 5. Live Feed. Audience members stream their perspectives to the screen using live, fur-covered camera devices. © The Institute for Interanimation.

As you walk around, you discover the room is full of these strange connections—a sound here activates an effect over there, moving a camera over there changes the projection here. There are no clear instructions and no formal guides, just objects, interfaces, and other participants. It is unclear what is "live" and what is fixed and difficult to determine when your actions will influence the system as a whole. You notice that the children in the space seem less cautious about their relationship to the system, and everyone seems drawn to the more direct and clear control paradigms (Figure 6). You're not sure what to do with this information.

Figure 6. A robotic turntable camera module is manipulated by a young guest of the institute. © The Institute for Interanimation

You lose yourself for a few minutes in a virtual reality pod that offers a 360-degree perspective into a movement performance that appears to be taking place in the same space (Figure 7). There was no performer outside the pod; are they from a different time? You gasp when upon turning around the dancer is suddenly in your face, "enough of that." You duck out of the pod only to discover that your audible gasp has now been added to the soundscape permeating the space. The system is using you.

Figure 7. Virtual Reality Pod with embedded 360-degree video of a dancer moving in the same space at another time. © The Institute for Interanimation

You stay in the space for about half an hour, cautiously exploring the various interconnected modules, inspecting the details, stepping back to watch the social dynamics. It is part science museum, part techno cult, and part Silicon Valley showroom. You're not sure how to feel—do you give in to the animated spectacle or keep your distance? You are wary of the undertones of control and the glorification of surveillance aesthetics.

You leave the same way you entered, but the animated heads seem slightly more ominous and the logo, still playful, becomes a knowing nod… The Institute for Interanimation—hmmm.

Interanimation: A Framework

As media artists, we find ourselves in a complex moment where the optimism surrounding digital technology which was prevalent in the 1980s and again during the dot com era has been appropriated by the control structures of late capitalism. The promise of free thought, anonymity, and fluid identity in the virtual realm, has become a complex tangle of surveillance, data mining, trolling, and gatekeeping. As technologists and artists, how can we continue to explore the potential of the digital realm for social and political change while not simultaneously being instrumentalized in the spectacle of Silicon Valley idealism?

The Institute for Interanimation (ii) is an attempt to play into this very tension, to build work right into the rift between technophilia and technophobia. The Institute for Interanimation was created to support systems that are ambiguous, complicated, and difficult, producing environments in which people can examine what role they are comfortable performing in this ubiquitous technoculture.

Co-developed by the authors to hold these often conflicting research perspectives (human care and technological progress) in tension, interanimation came to define our collaborative process and became a refrain to release tension during long work sessions. Interanimation navigates the unpredictable and forever shifting thresholds between real and virtual life, and the confusion generated by these overlapping modes of liveness.

Here, the word 'live' has a double meaning—"live" as in *to be alive* and to be *performing live*. Today's new media technologies urge us to reconsider both meanings. Immersive technologies, surveillance media, and new sensing systems not only shift our performance stages but they also continually affect what it means to be human, framing how we think and act. New media installations are adept at exploring the intersections and overlaps between these modes of liveness, combining technological perspectives (A.I., virtual reality, augmented life) and cultural perspectives (community, poetics, entertainment).

Merriam Webster defines "interanimate" as "to animate mutually," and that simple definition still guides our thinking. The concept of mutual animation has crept into our critical, technological, and creative spaces. In a concrete sense, interanimation happens when multiple bodies are in-motion together—human bodies, virtual bodies, technological bodies. It appeals to a continual shifting or reconsideration (of identity, of a 'piece', of value systems in general). The framework is a useful way of discussing the relationship between people and the technologies they create and use. In creating new tools and technical systems, we change, and as we change, our tools and systems evolve and transform as well. The Institute for Interanimation seeks to foreground this change, to embrace the mutual animation between the performer and instrument, user and interface, human and institute.

The notion of animation has embedded within it a similar tension. We can think about animation in this technical sense—the emergence of motion over time through a sequence of still images or frames. But we can also consider animation in a poetic sense, animating as the act or process of bringing to life, creating movement not as simply a useful effect, but as a vital mode of expression. Animation is an ideal tool for examining this double nature of (a)liveness, and it is also useful in thinking about the interfaces and objects we produced. The outputs of *Phase 3*, the first large-scale collaborative environment by the Institute for Interanimation, animate in a technical sense, resolving as motion in time. They are also lively in the poetic sense, asking guests to interact with systems as vital, willful agents.

Institutional Trajectories

Rather than attempting to project objectives in hindsight or appeal to a clarity of design, we have outlined four trajectories that represent how our ideas changed as the process unfolded. Our goal here is to document our collective movements and interanimations, attending to the ways in which our objectives shifted over the course of the year-long process.

Theoretical

The Institute of Interanimation (ii) was initially conceived as a hybrid research/practice platform exploring what it means to be alive and to perform live in the networked era. By combining new media perspectives from areas of theater, immersive video, sound, and interface design, we set out to think critically about the ways in which digital and networked technologies script individual and collective experience. Throughout the process, we returned to these considerations, but with a less deterministic lens. In working, it felt clear that while new digital technologies and those who develop them do script behavior and performance on and through them, the ways in which they are taken up institutionally have an even greater impact on our relationship to them and each other.

Design and engineering disciplines often create new interfaces and platforms for research and knowledge production within an academic context. We became interested in what value systems are embedded within these new technical systems, and how the arts, specifically open-ended processes, might contribute an alternative methodology for digital system design—perhaps less beholden to the tenants of efficiency and productivity.

As part of this project, we discussed who stands to benefit most from efficient interfacing. Efficiency requires a known goal or a predetermined destination, limiting the range of outcomes to produce the satisfaction of arrival. One can always be more efficient—it keeps things in order and under control. Efficiency produces not only predictable outcomes but predictable users. It works both ways. The Institute for Interanimation was designed as a home for the experimental, unpredictable, and often inefficient process of collective art-making.

Pedagogical

As educators, we are committed to creating learning environments through which faculty, students, and community artists work side by side, sharing skills, perspectives, and experiences. Another goal was to further introduce students to the affordances and frustrations of working with new technology in a practical setting.

In Spring 2017, we designed and co-developed an approach to teaching new media/digital performance in our classes, in different departments. One course focused primarily on sound and the other on projections and visuals. We also invited guest artist Andrew Scott to present his work and hold a workshop on projection mapping techniques for both groups of students.

While our initial plan for the courses included developing work for a large-scale production, we quickly realized that the dedication required would be asking a lot of many of our students. While the students we worked with in *Phase 3* came from those courses, participation in the project was not a required. The Institute for Interanimation became a place for students devoted to live media arts, and ultimately five students played major roles in the project's generation and execution.

Experimental

The Institute for Interanimation fostered a transformative working space through interdisciplinary exchanges. It allowed us to carve out a space and funding for interfacing between different types of artists and perspectives. The complexities of experience were welcomed, as were divergent approaches and methodologies.

The platform was developed not only as a creative collaboration between the authors but an opened-ended learning space for practical interdisciplinary project-based research. In addition to exposing students to a range of new media frameworks and providing hands-on experience with the affordances and frustrations of working with new technology, ii was also an exercise in collective dynamics. What started as a utopian model of horizontal collectivity where all creative perspectives were equal, became a centrally curated collection of interactive modules. This shift was born out of practical and economic considerations, in addition to internalized institutional pressures to produce a definable thing that functioned appropriately within a space used for theatre. This shift was both disappointing and revealing—and a frequent topic at ii board meetings/dinner parties.

Institutional Systems

From the onset, we wanted to play with the formality and fixity of traditional academic structures and the institutional frame provided a space for intervention—an institute dedicated to change and self-reflection seems at odds with the permanence and weight of typical institutional structures as well as columned grandeur of our University's campus. We borrowed institutional language from both academia and Silicon Valley tech companies. We used a few different generators and algorithms to combine text from eight local institutions and found ourselves with a mission statement and marketing text that played on the line between comedic nonsense and unsettling futurism. We gave every collaborator an institutional title—directors, fellows, and visiting fellows—and used computer generated texts for their biographies.

This interplay with the structures and practices of contemporary institutions and the techno-idealist culture of Silicon Valley permeated the exhibition's promotional materials as well. The invitation for *Phase 3* was generated from the marketing materials of several high profile institutions, and the talking points "production of social knowledge," and "economically sound," further complicated the goals of the system. From the invitation:

The Institute for Interanimation is pleased to announce phase 3 of our media platform, ii, an interactive environment navigating between here and there, now and then, on and off. We focus on economically sound virtual lives, supplying short-term low-impact hybrid mediums that use the human form to facilitate the production of social knowledge. By designing unique ethical realities into all of our products, ii ensures that your other selves will remain competitive in tomorrow's world. Don't miss this opportunity to escape the boundary condition. ii, another you.

Working within the frame of the Institute for Interanimation offered us an opportunity to examine some of the institutional structures we take for granted in the 21st century, but it also led to a few unexpected outcomes. Both the campus and Charlottesville communities were confused by the marketing language we generated. And to be honest, so were we. While we understood our remixes as critiques, people read them in all kinds of different ways, and leading up to *Phase 3,* the Institute for Interanimation lost its fixed identity, trading stability for curiosity.

Phase 3: An Interanimated Structure

Designed and produced at the University of Virginia in September 2017, *Phase 3*, was the Institute for Interanimation's first collective environment, combining live streaming media, responsive visual and musical systems, virtual realities, physical interfaces, and audience interaction. This complex system aimed to reimagine the social and expressive affordances/implications of new interface technologies through an interconnected and reactive set of audiovisual modules (Figure 8).

Figure 8. Audience interacting with different modules installed in *Phase 3*. © The Institute for Interanimation

Some modules were 'live' in that they required the guests to activate or play them, while other interfaces were 'live' in that they were autonomous and seemed alive.

The modules were in constant interanimation, connected to each other and continuously asking for contact. They were always in motion—swinging, clicking, speaking, turning—affecting each other in a complex tangle that made predetermined outcomes and precise repetition impossible. The audience was an integral part of the system as well. By activating and steering, by simply making connections (real or imagined) the audience brought the system to life.

Modules/Interfaces

Nine primary interfaces and modules were installed in a circle in the middle of a black box theatre, each with a distinct sculptural, sonic, and visual identity (Figure 9):

Virtual Reality Pod ⑧ was a large organically-shaped cone suspended from the ceiling. Guests could adjust the height to place their head inside it. A virtual reality headset inside the pod offered a 360-degree perspective on a dance performance, pre-recorded in the same space but at a different time. All audible sound made in the pod was added to the ambient soundscape permeating the space after a short delay.

Suspended Street Lamp ⑦ housed a screen projecting aerial footage captured from above the theatre. By turning the dial hanging from the post, the audience controlled the aerial footage, zooming in and out of the birds-eye view of the building. Spinning the dial also altered the pitch and ambient tones of the soundscape in the room.

Podium with a Spinning Table ⑤ was a chaotic turntable on which guests created moving animations using a collection of found objects, including a mirror, lenses, lights, and cameras. By placing objects in different configurations and adjusting the camera, audience members were able to create images that were projected on translucent screens hanging on the other end of the room ⑨. The podium resembled a strange conflation of organic materials and traditional interface elements, an animated control panel.

Interactive Objects: ④ These bouncy, playful objects were autonomous and generated auditory and visual outputs upon physical contact (they sensed motion using vibration switches). They were hung from the ceiling using elastic cables at different heights and in close proximity to each other and could (somewhat dangerously) be flung clear across the space.

Wire Portal: ③ Long piano wires connected an upside-down drum to the floor. Plucking and bowing the strings illuminated the drum and the sound of the strings was processed and echoed from the other end of the room, affecting the overall soundscape of the space.

Tube Sculpture: ⑥ was tangled and suspended from the ceiling, illuminated by a red spot light and slowly breathing (driven by motors). Pulling the plastic tubes triggered module ② across the circle.

Electro-Mechanical Sound Sculpture ② was constructed using discarded motors and actuators that were sequenced with an arduino microcontroller. This module appeared dormant for stretches until someone intentionally or accidentally moved the tubes ⑥ across the room.

Glowing Heads: ⑫ Projection-mapped glowing patterns (stripes, ramps, etc.) illuminated five rows of foam mannequin heads, each altered with a different sculptural mask, obfuscating their identities.

Forest of Strings ① filled the entire back corner, acting both as a screen and an environment for exploration. The area was surveilled by an overhead camera and the live footage was projected onto a translucent screen across the room. The string network was the only non-responsive area in the installation space even though it appeared to many to control some audio/visual aspects in the room.

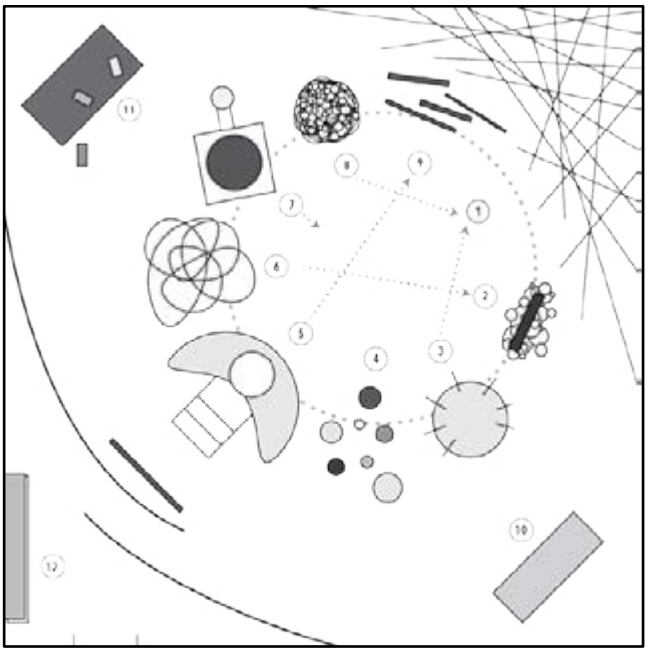

Figure 9. *Phase 3* diagram of the space, depicting the positioning of modules/interfaces and their relationship to each other

Environment

Installing this piece in a black box theater allowed us to create an environment that appeared distinct from the outside world. We were able to keep the space mysteriously dark while illuminating specific modules using dim spot lights and occasional LEDs. In designing the modules and interfaces, we chose a set of textures and materials and stuck to them for motivic coherence. The materials were complicated hybrids themselves—fur, expanding foam, plexiglass, elastic. They each provided a unique tactile experience with some type of animation built in. The modules were furry interfaces, squishy objects, and bendable screens—not your typical technofetishistic materials (Figure 10).

Figure 10. An audience member experiencing the Virtual Reality Pod. © The Institute for Interanimation

Experience

In designing *Phase 3*, our goal was to create a playful, sensory experience that elicited curiosity and provided a space for reflection. An audience member explained the sense of wonderment as both engaging and challenging: "[I was] both unsettled and eager while walking through the room, I felt challenged by the 'games' within the exhibit." The system was a live organism that continued to evolve throughout the course of the exhibit—breaking, reforming, evolving, and adapting.

There was no single roadmap regarding how the audience could interact with the exhibit and no experience could be precisely replicated or repeated. We wanted to set up a situation or a 'set of possibilities' that affect or inspire each other, rather than a linear piece that moves predictably from beginning to end. Reflecting on the ongoing state of change and interanimation, one of the audience members wrote, "If there were any goal to this project, it would be opening up to inquiry the idea of independent, agentive bodies existing within a given space. What became eminently clear to me, in the space 'between here and there,' was that no action I made was independent. Rather, my very being was constituted by the environment in which I found myself."

By participating in *Phase 3*, guests became implicated in an ongoing state of performance, sometimes willingly and sometimes unexpectedly. They were encouraged to collectively record parts of the environment through fur covered cameras and stream their perspective to the web, visible on a glowing screen lying flat in the corner of the room ⑪ (Figure 9). In generating sound and visual content, the audience left their imprint on the environment and the system imprecisely registered their movements and actions. On the one hand, guests were given control over the space by poking, prodding, and prompting it. On the other hand, the system (and the authors) encouraged certain behaviors and types of performances.

Additionally, alluding to the ubiquity of surveillance in our contemporary life, multiple cameras were installed around the room, including an overhead camera that provided a livestream of the very space the audience were inhabiting. By engaging with the system, the audience positioned themselves within the frame of video surveillance, a feeling reinforced by the institute's generated language and resonating with the system of data sharing that takes place online.

Reception

The audience reaction to *Phase 3* was fascinating and varied. Some people were timid at first encountering the exhibit. Different from most art experiences in Charlottesville, Virginia, the installation encouraged open-

ended and tactile interaction with handmade objects, which several visitors found unsettling at first. This sentiment was reflected in a student review, "It took me awhile to find the courage to begin experimenting with the exhibit. I had my reservations: what if I did something incorrectly, something I wasn't supposed to do? Or worse, what if I broke something and ruined the exhibit?"

Somewhat unsurprisingly, younger visitors were very comfortable immersing themselves in the space, exploring and interacting with the modules seemed more natural to them. Not only were children excited to manipulate the sounds and images in the space, but they were also delighted at seeing themselves represented in the system. While adults tended to recoil in realizing that their voice was now part of the room's soundscape, children were excited to add their part, singing, talking, and sometimes screaming into the various sound sensors around the space.

Groups generally were more emboldened than individuals, and small groups clustered around stations, sharing experiences locally, and trying to understand the relationships between the elements. For many, the puzzle aspect of the environment was as interesting as the aesthetic aspects. People wanted to figure things out, and because of this drive, some people left frustrated, as this was a space for figuring in.

Some visitors wandered in alone and methodically engaged with each individual module, others just sat in the middle of the room and observed. Most of the visitors wanted to share their observations and findings with other visitors. One audience member expressed: "I didn't want to wander alone and enjoy it quietly, as I usually tend to do in art exhibitions. I appreciated this aspect of interanimation, and it made me more aware of the community aspect of art enjoyment."

Despite its playful and sinister framing, the piece was not easy, and many guests expressed relief when interactions and relationships were revealed to them. Others were at home with the complexity and appreciated the mystery, "The unexpected connections between ostensibly unrelated objects dumbfounded me, and it was a fairly long process of becoming acquainted with the exhibit as a whole. The vexing fabrication of each individual object, and the full extent to which they are interconnected, still remains mysterious to me. I found this thrilling as such."

Collaboration

Phase 3 was the result of a year-long interdisciplinary collaboration between the authors, Mona Kasra and Peter Bussigel. As the first project of the Institute for Interanimation, *Phase 3* was designed to be part pedagogical, and many of the decisions made throughout the process were chosen for learning potential (and interanimation potential) rather than success within any one formal value system like Theater, Installation, Music, even Project and Institution.

To build *Phase 3*, a team of five students (Will Mullany, Aspen Miller, Dallas Simms, Ron Lam, and Amber Boucard) and two local community artists (Annie Temmink and Alan Goffinski) worked together over the course of a month, constructing the physical elements, soldering the electronic elements, and coding the digital elements. Members of the collective brought varied backgrounds and skill sets to the project, including costume design, visual art and design, sound/composition, etc. Working as a collective allowed us to share skills and carve out a space for interfacing between different artistic and technological perspectives. The complexities of the experience were welcomed, as were divergent approaches and methodologies.

The project was funded through a grant and was collectively authored among the team members. All collaborators were paid, and while the authors facilitated the efforts and ultimately made some decisions about the overall direction of the production, all of the participating artists were represented in *Phase 3* and the collective continues to live on through various projects that have grown out from the process. In a sense, given the fast-paced and kaleidoscopic nature of the production, nothing felt finished, but when the show came down, we all had ideas that we wanted to expand on, and smaller collaborations that are still ongoing today.

Platform and Challenges

The Institute for Interanimation allows for failure. Only about 30% of the modules that the group discussed made it to *Phase 3* and until things settled in that final month, collaborators came and went, there were days of directionless discussion, and times where is felt as if everyone was on a different page. Interdisciplinarity is a deeply tired buzzword, and the Institute for Interanimation attempted to take on the challenge of unpacking it. Does the academic discourse around interdisciplinarity refer to media output? Hybrid process? Collective authorship? A bit of everything?

We set out with the nebulous overarching goal of doing things differently, especially with respect to large scale creative collaboration within a research institution. We tried to employ progressive labor practices and nonhierarchical structures, but these desires were often complicated by the larger structures we were working within. We poked at the institutional marketing machine and made something that was difficult to define, and while most of the UVA community was excited about the project, it was not without controversy. This was a well funded project that largely fell outside of traditional value systems. Collectively, we are still working through the ethics and utility of this frame. In a sense, we used a playful institutional frame to allow us to explore some of the more sinister aspects of techno-utopian thinking, hiding behind the mask of a character.

From a creative and generative standpoint, the diffractive nature of the project will lead to more work and provided a rich canvas for thinking through liveness from a variety of perspectives. From an institutional standpoint, it would be difficult to argue that we did much to subvert or reveal the oppressive structures we set out to disturb.

Throughout the process, it was critical to remember that the framework of interanimation is not built for efficiency. It is an experimental and pedagogical process that encourages creative collisions and allows for a deep exploration of interfacing and identity, but it is certainly not the easiest way to build a production. Complication notwithstanding, it feels like an important alternative to the more streamlined production processes. And in many ways, it seems more attuned to current social and technical complexities.

Conclusion

This paper, much like the Institute for Interanimation, attends to the ways in which new systems shift how we live and how we perform. The Institute for Interanimation continues, and there are more projects in the works within this framing device. *Phase 3* was often chaotic, at times problematic, and produced many moments of collective and individual animation. An organization dedicated to interanimation and navigating the unpredictable and forever shifting thresholds between the real and the virtual will always be a complicated structure to maintain. To hold onto to interanimation, we were forced to let go of some individual values. For us, that was and is the core of this experiment, a continual calling into question.

Acknowledgments

We thank our colleagues, collaborators, and students for their continued inspiration and encouragement. This work has been made possible through the support of a Faculty Research Grant for the Arts from Office of the Provost and Vice Provost for the Arts at the University of Virginia.

Authors Biographies

Mona Kasra is an Assistant Professor of Digital Media Design at the University of Virginia (UVa). A new media artist and an interdisciplinary scholar, she examines, explores, and experiments with existing and emerging media in the context of art making, storytelling, and installation. In 2016, she served as Conference Chair at ACM SIGGRAPH, undertaking an engaged role in the strategic planning, leading, and managing of the world's largest, most influential annual conference on the theory and practice of computer graphics and interactive techniques.

Peter Bussigel is a composer and intermedia artist working with sound, video, and performance. His projects include audiovisual instruments, interactive software systems, sound installations, experimental videos, and concert games. Peter is active as a performer on brass instruments and electronics and frequently collaborates with playwrights, game designers, theorists, and choreographers. Peter is an Assistant Professor in New Media + Sound Arts at Emily Carr University of Art + Design in Vancouver, Canada.

Hoax News Websites at the Crossroad between Popular and Political

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Abstract

This paper aims to analyze satirical hoax news websites in relation to local, regional and global mobilizations. To achieve this, a corpus of three websites is selected: *The Onion* (USA), *Zaytung* (Turkey) and *El Koshary Today* (Egypt). The objective is to retrace the history of online content productions before, during and after the movements of Gezi, Tahrir and Occupy. The purpose of this study is to understand and analyze the phenomenon of satirical newspaper websites through the evolution of topics and subjects, the use of language, participatory content production, the differences and similarities between selected cases.

Keywords

Art, activism, Occupy, Gezi, Tahrir, language, internet, aesthetic experience, dissensus.

Introduction

The essence of our approach lies in our objective to demonstrate the links between everyday life, the arts, politics and the media. There is a "continuity" between these domains as many philosophers and writers claim, among them Dewey, Rancière, Baudrillard, Foucault. We study the connection between the political events and online cultural productions, while questioning the digital arts, and internet aesthetics through an analysis of selected websites in connection to the movements that broke out after the great recession of 2008 to end 2013.

We have witnessed the transformation of the industrial society towards a post-industrial society. During this transformation, the digital revolution has influenced protests especially their way of communication and tools, it also has deeply changed professional and social life. Even the smartphones have shifted our work hours, our habits of reading and answering e-mails, or our relation with the public and private space. In parallel, we've witnessed important social movements around the world, and they are still popping-up. The causes and consequences of these mobilizations are diverse, but there are important points in common. Castells lists them as follows: "It was not just poverty, or the economic crisis, or the lack of democracy that caused the multifaceted rebellion. Of course, all these poignant manifestations of an unjust society and of an undemocratic polity were present in the protests. But it was primarily the humiliation provoked by the cynicism and arrogance of those in power, be it financial, political or cultural, that brought together those who turned fear into outrage and outrage into hope for a better humanity" (Castells, 2012, 2-3).

This atmosphere of struggle around these movements has also increased the productivity and creativity of the opposition and protesters. Their reactions on the street and in the web were intelligent and ironic; they had created their own language and codes. Those "new modalities of action" find their roots in the events of Seattle 1990, and in several collective actions through the 1990s and 2000s. Regarding the online productions, we may include the hoax news websites, the fictitious personalities, the fake accounts of real personalities, piracy, modified posters (or memes), which are mentioned in detail in our doctoral research. One of these productions, a common phenomenon of our "post-industrial" societies is the hoax news websites. They question the realities of everyday life and politics, draw attention to the role of the media in misinformation and credibility of the mass media. They transform or divert the news on a humorous register, as the *situationists* would do. Despite some differences within, these sites have a collective, participatory culture and a common language.

Satirical hoax sites exist in several countries. Here we opt for a comparison between three cases: *Zaytung* (Turkey), *The Onion* (United States), *El Koshary Today* (Egypt). How should we read this type of production? Who are the producers or co-producers of the content, and who are the "consumers"? How do the production and dissemination processes work? What are the peculiarities of their language(s), what are the similarities with the codes of the mass media? Is it a community language? What are their relations with social and political events? In response, our methodology will be to conduct data analysis and interview the founders and publishers of these platforms.

Truth and Trust Towards the Media

For Foucault, "history is like a sequence of fictions, as truths change according to the structures of power, [...]. Truth is a function of language (that is, culture), which is created by humans, [...]. Each culture builds its own version of what is true (and what is not), and the system to recognize it. "Truth" is a "system of ordered procedures for the production,

regulation, distribution, circulation and exploitation of states"; which is connected "by a circular relation to the systems of power that produce and support it, and to the effects of power that incite and redirect it" (Foucault, 1976). From this point of view, Jones Gray and Thompson's comment about the satirical take on their full meaning: "the unique ability of satire ... is to tell the truth to power" (Gray, Jones, and Thompson, 2009, 6).

In recent years, especially since the 9/11 attacks and the US intervention in Iraq, trust in the traditional media has diminished significantly. According to a poll by The Gallup Organization, only 40% of Americans would trust the media. Another survey conducted in the United Kingdom reveals that the most read newspapers are the least reliable. Jones and Baym wrote for United Kingdom: "As we have seen in the past decade on nearly every issue of public significance—from the invasion of Iraq in 2003, to the economic crisis of 2008, to the health care debate of 2009—when we have deeply needed critical information and reasoned debate, the most influential sources of television news instead provided a steady and often debilitating diet of distraction, distortion, spectacle, and spin." (Jones and Baym, 2010, 281). According to Pew research report, only 5% of Americans aged between 18-29, would read the print media. The proportion of Americans who follow information on a mobile device has increased from 54% in 2013 to 72% in 2018. People aged 50 and over (22%) would have more confidence on the national press than 18-29-year old (10%) and 30-49-year old (16%). On the other hand, a significant proportion of the population has confidence in the Colbert Report and Daily Show with Jon Stewart, the two American satirical television shows.

In Turkey as well, the media are losing the confidence of an important part of the population. All media outlets occupy the last place in the list of institutions that the citizens trust in; such as the army, the president of the republic, the police, the government, the NGOs or the political parties. For his part, Lüküslü observes that the majority of young people who are interested in political news, would not trust political organizations or the mass media (Lüküslü, 2014, 78-79). Konda's study of the Gezi movement confirms this trend: social networks (34%) and websites (11%) would be the main source of information for young people (18-28 years old). Over 44 years old, 5% use social media and 2% use the Internet, and for 88% of this group, television would be the main source of information (Konda, p. 22-28).

Several studies have been conducted in Egypt as well. The first source of information for Egyptians would be television. The country's English-speaking elite has access to diverse sources, including foreign sources. It would also give greater confidence to both foreign and national sources of information. In addition, there is an increase in the use of social networks, particularly by bloggers and Twittos (Hamdy, 2013).

Graham Meikle draws a connection between satire and media study: "[…] both ask questions about power and influence, both make judgments about social, cultural and political standards and failings, both are forms of cultural criticism." (Meikle, 2008). In the light of this approach we try to analyze how do uprising people response to the current political events daily realities in our "post-truth era".

Hoax and Satire

During the 1990s in Europe, particularly in Eastern Europe, Italy, and the United States, activist artistic projects such as Yes Men, Luther Blissett project, etc. emerged. They challenged the notions of 'information', 'reality' and 'perception', These projects were mainly influenced by the writings of William S. Burroughs and Hakim Bey on the media and the manipulation of information. Both authors proposed to "hack" the media, the tools of communication. Cornelia Solfrank draws an interesting parallel between art and the term hack: "if you take a closer look at the term "hack," you very quickly discover that hacking is an artistic way of dealing with a computer. [...] hacking does have to do with limitations, but even more with norms. [...] The only thing art actually does is break the patterns and habits of perception. Art should break open the categories and systems we use in order to get through life along as straight a line as possible. Everyone has these patterns and systems in his or her head. Then along comes art: What we're used to is disturbed, and we're taken by surprise. New and unusual patterns of perception offer up the same things in a completely new context. In this way, thought systems are called into question." (Baumgärtel, 1998). The hacktivists thus create radios and pirate TVs, fanzines, fictitious personalities, false identities. Hence, we affirm that the satirical newspapers offer "ordinary people" an opportunity to "hack" social and political clichés, and to question these norms.

Even though these last examples are recent, the hoax has a long history. Excerpts from Jonathan Swift and Mark Twain on the shows of Jon Stewart and Stephen Colbert, mostly in the form of satire. A satire is a written or oral speech in which the author criticizes the faults, the customs, the norms of his or her time often in an ironic way. According to Phiddian satire is "a rhetorical strategy (in any medium) that seeks wittily to provoke an emotional and intellectual reaction in an audience on a matter of public (or at least inter-subjective) significance" (Phiddian, 2013).

Megan R. Hill mentions Griffin on this issue: "[...] satirists should seek to harm the current system and to create confusion, even if only momentarily, in people's understanding of how the world works, challenging their attitudes and opinions, taunting and provoking them into doubt, and perhaps into disbelief." But he is not the only idealist, Hill also mentions Burke: "By offering a new way of looking at "normal reality", the satirists' strategy calls into question the taken-for-granted assumptions (i.e. the master narrative) underpinning social life and therefore, attempts to awaken citizens' perceptions by illustrating that "one's way of seeing is, inevitably, a way of not seeing" and she adds as a comment: "The ultimate provocation of satire is thus to make people aware of the lenses they see with." (Hill, 2013, 379). That's the main point of our approach to

link our data to Jacques Rancière's and Dewey's theories on aesthetics as an experience and as a moment of *dissensus*, and to the distancing effect of Brecht. In the second part of this paper we will discuss this issue by case studies.

Data and Methodology

Our corpus includes two sites from Mediterranean countries with strong cultural and political differences, and a North American site. The latter was chosen because of the cultural influence of the United States in the world but also because the usage of English, occupies an important place in the language of the movements of Gezi, Tahrir and Occupy and in the online contents. We have constructed our corpus with four criteria: Access to the sources that concern these three movements; fluency in the language; the existence of similar productions which link social networks and these movements; and Internet access in the countries concerned.

The *Netvizz* application allowed us to download the open, shared data on the Facebook pages of the corpus sites (not including the public posts on the page). Note that the three sites have inequalities in the number of published content. We have started with *The Onion*, which has 13,000 publications (over five years). This allowed us to discover the limitations of data analysis and text mining software (explained below). We first analyzed the texts using the software to determine the general trend of the site. Then we separated the publications in three-month periods and studied their links to political news.

At the end of this analysis, we found it difficult to evaluate the importance of the published topics in relation to current events. For example, during debates on gay marriage in the United States, *The Onion*'s Facebook page shows an increase in publications of articles on the same topic. However, further analysis reveals that gay marriage was already a topic on the page before the social debate started and before the discussions and decisions of the federated states. But this subject was not identified as important by the software due to normal attendance. To isolate this variant, we decided to do a semi-manual analysis and tighten our sample on the Facebook publications that

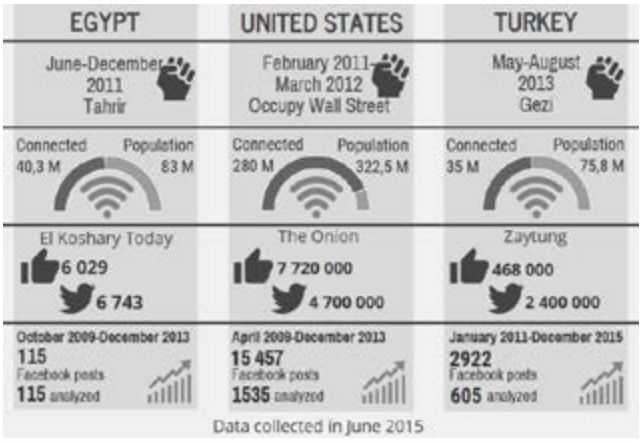

Figure 1. Web statistics, 2015. Population statistics, 2016.

generated more engagement (likes and shares), knowing that the more a publication created an engagement, the more Facebook's algorithm makes it visible to other followers of the page, and to the friends of the followers of the page (see Figure 1).

We conducted an interview with Hakan Bilginer, the founder of *Zaytung*, on May 23, 2015. But we could not *reach El Koshary Today* who has not posted anything on Facebook and on the website since January 2014. We have tried to contact them on all their media and social accounts without success. As for *The Onion*'s Facebook page and Twitter account, they do not accept private messages. And they did not respond to any of the emails we sent them. We have then decided to use other sources such as newspaper articles, radio and TV interviews of the editors of all three websites.

Visual and Form

Satirical sites have the same appearance as "real" newspapers; they also broadcast weekly magazines, horoscopes, sports pages, etc. The mentioned subjects are similar, as Meikle speaks of too on media satire, there is "similarity of form and content". The contents revolve around the following themes: political, social, economic, religion, sex, celebrities, couples, ... as those are the privileged themes of humorists for centuries.

Most satirical sites of fake news find their roots in *The Onion*, as mentioned in the interviews of the founders of the various sites, including those of *Zaytung* and *El Koshary Today*. However, *The Onion* has a difference: the site also produces audio-visual content with the participation of professional journalists, or actors. Audio-visual contents are not part of our analysis unless it is shared as a full text paper on Facebook or on the website.

These sites parody the mass media by appropriating their codes to encourage readers to question the credibility of conventional sources. The hoax papers look like those of the *Wall Street Journal* or *New York Times*. In their interviews, Joe Garden and Chad Nackers from *The Onion* explain why they produce audiovisual content on the format of traditional media. This resemblance would allow them to benefit from the same status of authority and legitimacy (authority to give information) as the dominant media and thereby reinforcing the satire. *Zaytung* founder Hakan Bilginer explains: "When you use traditional media codes, what you produce is like "real information", whatever the content is. You read a real newspaper article, written in a journalistic language using verbs like: declares, expresses, underlines, etc. We do the same thing except that at the end it is pointed out that it is a joke all in the last sentence."

The slogans (mottos, tags) of these sites also reflect their critical approach vis-à-vis the traditional media: *Zaytung* "Dürüst, tarafsız, ahlaksız haber" [Honest, objective and immoral news]. *The Onion* "America's finest news source", *El Koshary Today* "Egypt's most reliable news source". *The Onion* also has this Latin phrase "Tu Stultus Es" (You're stupid.). This motto seems to mean that the satirical site produces these contents for stupid people, and if the reader

is there to interpret the content in a real way, it means that he is stupid. It also implies that readers are stupid to believe what they read on *The Onion*, also on "real" newspapers.

At the bottom of the web page, they have the same icons (like, share, etc.) for social media links, and the copyright notes like those of real newspapers :

- *The Onion* is not intended for readers under 18 years of age. © All rights reserved 2017 Onion Inc.
- Decree by the Zaytung Public Relations Department: All written and visual materials on this site, even html codes, are fake [lies]. Those who have a bone age of less than 18 years are not allowed to visit the site, even if it's just to check out quickly for a friend. Finally, we would be very grateful if you don't sue us. Cordially. Hosted by radore.
- © 2009 El Koshary. All rights reserved. Designed and developed in-house, using Drupal.

The sites also have a section dedicated to public opinion: *Halkın Sesi* [The voice of the people] on *Zaytung, Americas Voices* on *The Onion*. In this section, the sites parody polls. They claim that they ask the public their opinion on a hot topic. They always use the same pictures (3-4 people), and under the pictures is the answer of the person. The name, age and profession of the person in the photo change every time.

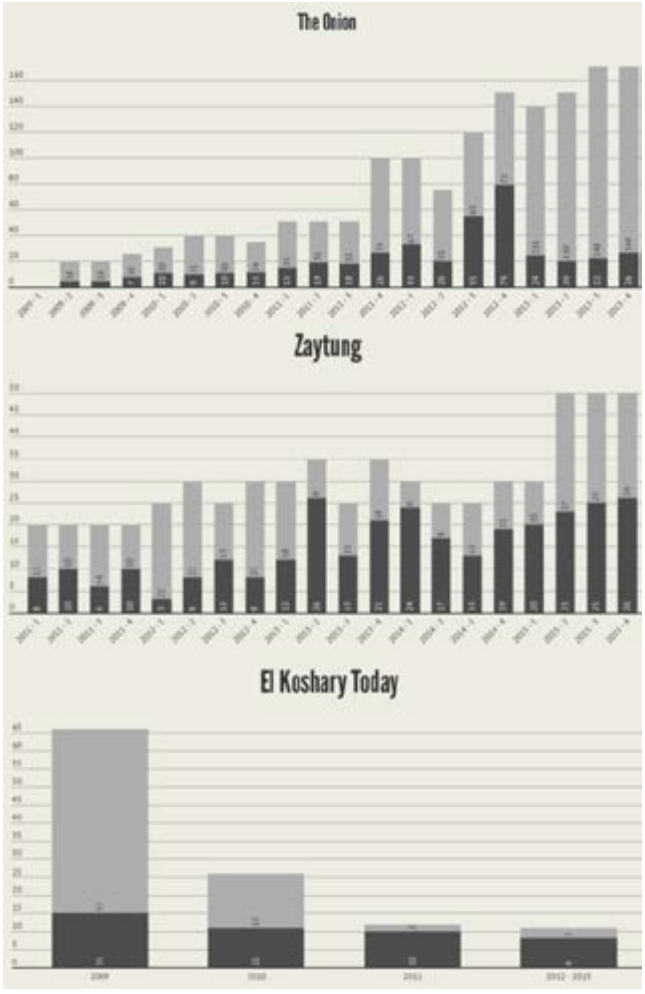

Figure 2. Dark gray for political content, light gray for other.

Themes and Subjects

Articles cover current topics, political and / or family life of politicians, but also lifestyles, romantic and sexual relationships, science, technology, and religion. Graham Meikle points out that these web sites belong to a mash-up culture, it is a remix aesthetic. They mix topics in a relevant way, as predicted by Burroughs and Situationists (cut-up). There are sometimes links between the two or three themes in the satirical sites. Religion, being a footballer or gay can be mentioned in a single article for example. As a result, we noted that a more detailed categorization needed to be done to improve the presentation of results. For this reason, we have defined the themes and subchapters as follows.

Politics

The (studied) political theme is divided into five sub-categories:

1) Publications concerning political news and elections: During the election periods, we observed an increase in political content, discussions on elections and candidates. *The Onion* is preparing a special column for the elections.

2) The daily life of the politicians must be analyzed in the broad sense: subjects on the members of the leaders' families, on their participation in the social events or sports. For example: *Diamond Joe Biden*, a character created by *The Onion* in the image of the real Joe Biden (former vice president of the United States).

3) Scandals and corruptions. Especially the corruptions in Turkey unveiled in December 2013 were parodied by

Subsection: News
Title: "**Obama Takes Excited Daughters Out for Day of Drone-Watching**"
Publication time: 6/05/13 1:59pm
Text: "WANA, PAKISTAN—Calling it a chance to get some fresh air and learn about the unmanned aerial vehicles inhabiting the Middle East, President Barack Obama took his daughters Sasha and Malia out to the tribal territories of Pakistan for an exciting afternoon of drone-watching, sources confirmed Wednesday. "Look, there's one right there," Obama reportedly whispered as he handed a pair of binoculars to his youngest daughter Sasha, keeping quiet so as not to alarm the RQ-11B Raven drone sweeping past a nearby mountain ridge. "And there's another—that's an MQ-9 Block 1-Plus Reaper. You can tell by the markings on its wings. Just a beautiful, beautiful drone. You may not see as many of those as you used to, but around here they're still the kings of the sky." According to reports, Obama then told the two girls that if they came back at nightfall, they might get to see a drone attacking its prey."
© 2018 Onion Inc.

Zaytung. *The Onion* also made several references to the sex tape of the CIA director in November 2012.
4) Foreign affairs, leaders and policies of other countries: The sites publish articles about international events and meetings like G20 or negotiations between Greece and the European Union.
5) Everything related to economic, urban, energy and environmental policies: For example, the articles on the technical problems of *Marmaray* (a railway connecting the two sides of Bosphorus, in Istanbul) in October and November 2013.
In the table above, we see the evolution of the proportion of political theme and other themes over time in *The Onion* and *Zaytung* (Figure 2). Due to the small sample size for El Koshary Today, the graph for this one is annual. In our thesis, we also highlight the links between the different themes with examples, including detailed tables and visuals, and adapted to local and global discussions. In this article, the demonstration will be limited to the numerical evolution of political theme.

Daily life and clichés

Satire sites also target the "ideal life" image offered to "middle class" workers, especially those working in *bullshit jobs* (jobs in the service sector that do not lead to actual production as defined by David Graeber). For example, in the mass media, one usually notices articles entitled "Where to eat this weekend?". A way to advertise restaurants, a certain way of life, or "extraordinary" holidays, etc. Satirical sites also hijack them. For example, *Zaytung* publishes an article about an engineer who has no more money at the end of the month, and who receives a text message from his girlfriend to go out. The objective here is to highlight the contrast between reality and the image constructed and returned by the mass media. Subcategories of this theme are:
1) Jokes of Mercury-Venus, LGBTI (jokes on gender roles, relationships and sexuality)
2) Jokes about social media tools: They relate to users who share photos of engagements, weddings or couples in love; older users or loved ones with whom we do not want to be in contact on social media; on interface changes (like switching to Timeline View in Facebook).
3) Area Man / Nation jokes: Humor about everyday life: there is no special time for this kind of content. The event described in the article can happen to anyone and anytime. Satirical sites tend to use the same places and / or people for this type of news.
4) Jokes related to work, "bullshit jobs", mobbing, and unemployment, unemployed: We observed that sites refer to youth unemployment, and such as after graduations in June or July, they create articles about this issue.
5) Religion is a common theme: The three sites treat this subject differently. *The Onion* mixes this topic with taboo topics like gay marriage, or pedophilia. On *Zaytung* and *El Koshary Today*, the subject is rather related to institutions and political actions relating to religion.

The other themes are: sports, science and technology celebrities and unclassified subjects. The common language between satirical sites and social movements is not limited to political themes. They also cover topics such as the launch of the new iPhone, from an economic or social policy point of view, in connection with the national news. This overview? is what creates a language and common codes and gives a "symbolic power" to its producers.

Subsection: Workplace
Title: "**New College Graduates To Be Cryogenically Frozen Until Job Market Improves**"
Publication time: 3/15/10 5:00pm
Text: "WASHINGTON—In a bold new measure intended to address unemployment among young professionals, lawmakers from across the political spectrum agreed on legislation Tuesday to subsidize the cryogenic freezing of recent college graduates until the job market recovers. The bill, expected to swiftly pass in both houses, would facilitate the subzero preservation of any graduate of a two- or four-year educational institution. […] "
Text under photo: "Grads would be cryopreserved immediately after receiving their diplomas."

Subsection: Valentine's Day
Title: "**20,000 Tons Of Pubic Hair Trimmed In Preparation For Valentine's Day**"
Publication time: 2/11/10 8:00am
Text: WASHINGTON—Flushed with anticipation and ready to emerge from another long, cold winter, millions of Americans participated this week in the annual tradition of trimming their pubic regions in time for Valentine's Day. A ritual as old as time itself, this year's pubis-shearing is expected to be among the largest in decades, with more than 20,000 tons of curly clippings predicted to fall by Feb. 14. […] "
Text under photo: "Americans all across the country once again prepared for Valentine's Day by carefully thinning their pubis."

Cultural and linguistic codes

For readers, it is not always easy to understand the content of these sites, since they include many specific references to political and social news. To understand them, the reader must know the "codes" as defined by Umberto Eco. We observed that sites sometimes deal with the same topics or events by offering different points of view. The difference can be cultural or political; or linked to the divergence of humorous approaches according to the culture. We have noticed some of the methods and barriers that Shifman and Levy have identified, such as "cultural substitution", the replacement of extralinguistic cultural values by elements that are well known in the target culture. To give an example: exchanging the name of a celebrity with that of a local celebrity. The "cultural affinity" between two cultures

Subsection: Internet
Title: "**Entire Facebook Staff Laughs As Man Tightens Privacy Settings**"
Publication time: 5/26/10 11:30am
Text: "PALO ALTO, CA—All 1,472 employees of Facebook, Inc. reportedly burst out in uncontrollable laughter Wednesday following Albuquerque resident Jason Herrick's attempts to protect his personal information from exploitation on the social-networking site. "Look, he's clicking 'Friends Only' for his e-mail address. Like that's going to make a difference!" howled infrastructure manager Evan Hollingsworth, tears streaming down his face, to several of his doubled-over coworkers. "Oh, sure, by all means, Jason, 'delete' that photo. Man, this is so rich." According to internal sources, the entire staff of Facebook was left gasping for air minutes later when the "hilarious" Herrick believed he had actually blocked third-party ads."
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Subsection: Local
Title: "**Gay Teen Worried He Might Be Christian**"
Publication time: 1/12/10 5:00pm
Text: "LOUISVILLE, KY—At first glance, high school senior Lucas Faber, 18, seems like any ordinary gay teen. He's a member of his school's swing choir, enjoys shopping at the mall, and has sex with other males his age. But lately, a growing worry has begun to plague this young gay man. A gnawing feeling that, deep down, he may be a fundamentalist, right-wing Christian. "I don't know what's happening to me," Faber admitted to reporters Monday. "It's like I get these weird urges sometimes, and suddenly I'm tempted to go behind my friends' backs and attend a megachurch service, or censor books in the school library in some way. Even just the thought of organizing a CD-burning turns me on.""
Text under photo: "Lucas Faber has tried focusing on Godspell to keep the thought of tithing out of his mind."
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and linguistic proximity influences the use of the same jokes at different sites. And that some themes - such as computers and gender differences - will cross national borders better than others.

As observed in Ermida's case studies, the texts start with a title and then present a first sentence containing the most important information. They then develop this information with details of decreasing importance (parallel to the rule of the "inverted pyramid" of journalism). The titles of the articles are of great importance, the founders, authors and editors of *Zaytung* and *The Onion* declared that they define the title first. *The Onion* staff begins with 800-1000 titles and eliminates 97% of them, as part of their weekly routine.

In short, as pointed out by Jones and Baym "[...] irony and satire demand a far more active process of engagement on the part of the audience than does the monological and literal modality of news. [...] the audience first has to *figure it out*, [...] read between the lines, [...] has to perform some relatively complex interpretive labor, connecting dots that often require an extensive set of competencies, both political and cultural." Thus, satire offers us an active and performative citizenship (Jones et Baym, 2010, 290-291).

Jokes to hack the established order

We observed that *Zaytung* and *El Koshary Today* were more politically engaged than *The Onion*. Both have done more publications related to politics and mobilizations. However, it should be noted that *The Onion* has a more professional structure and exists since 1988 in print, and online since 1996 (currently only online since 2013). In this part of the article we sought to understand if there was a relationship between these sites and social mobilizations.

The authors of *El Koshary Today* said in a radio interview that they have targeted the middle-upper class that holds power in Egypt and that class will make the revolution. The founder of *Zaytung* informed us that he participated individually to the mobilizations (National Public Radio, US, June 18, 2012). In the *Facebook* data we analyzed, we also found their call to fight against a censorship law in 2011 and their call to join to the Gezi movement, on May 31, 2013. *El Koshary Today* team also appealed to manifest on their Facebook page on January 27, 2011.

The Onion editor Chad Nackers and publisher Cole Bolton told the radio that their cynicism was about getting people into action, pushing them to do the right thing, and making them laugh. Jones and Baym confirm this "revolutionary" aspect of humor: "Philosophers who study ancient Greece argue that cynicism is not this modern notion of detachment, smugness, or lack of commitment. Rather, it is a proactive protest, against and objection to corruption, self-interest, luxury, hypocrisy, and insincerity that so easily infects and dominates politics." (Jones et Baym, 2010, 288). *Zaytung* founder Hakan Bilginer said there was already a dialogue between the site and the young people who participated in the mobilizations before the street movement begin. These young people visited the sites and produced content well before demonstrating their creativity on the street.

In addition, it is difficult to know if satire must have a reformist role in society; it seems to us fundamental that it should rather create a moment of estrangement or dissensus. Interviews and data analysis show us that satirists tend to question sources of information and power, as Meikle writes: "First, satirists draw attention to the workings of media power – in particular, they open up an analysis of media in terms of symbolic power. Second, satire matters to media scholars, because there are parallels between satire on the one hand and academic media criticism on the other, and a examination of these parallels can help set each in a fresh context." (Meikle, 2008)

Participators, producers, visitors, co-creators

To what degree have satirical hoax sites been successful, open to the public? In the past, satirists, political opinion leaders, were professionals employed by the media, who managed the flow of information for the masses. With the advent of the Internet, as Berthon et al. cited by Lijun Tang

Subsection: Local
Title: "**8.4 Million New Yorkers Suddenly Realize New York City A Horrible Place To Live**"
Publication time: 9/02/10 8:00am
Subtitle: "NEW YORK—At 4:32 p.m. Tuesday, every single resident of New York City decided to evacuate the famed metropolis, having realized it was nothing more than a massive, trash-ridden hellhole that slowly sucks the life out of every one of its inhabitants."
Text under photo: "Within 90 minutes, the borough of Brooklyn had completely cleared out."

and Syamantak Bhattacharya, "Satire has been liberated from the monopoly of professionals and the Internet has enabled ordinary people, or netizens, to create and disseminate satirical work online." (Tang and Syamantak, 2011). The hoax news websites too offer "ordinary people" the opportunity to "hack" daily routines and make readers reflect on these routines. Guy Debord expresses the need to change the world and envisages the diversion of existing forms by "organized collective work" aiming at a unitary use of all means to disrupt everyday life.

The production process is collective and participatory. On the collective production of the content or an action, we can refer to the notion of social sculpture attributed to Beuys, it is not necessary to be geek, expert or member of a specific community to create and share satirical texts. The idea of a participatory radio of Walter Benjamin's listener also corresponds to the idea of collective production of individuals. On all three sites, it is possible to send proposals for publication. For *Zaytung*, you must register first on the site for free, and then fill out an article proposal form. For *The Onion*, this first step is to be a *collaborator* (unsolicited contributor). The next step is to be part of the team by becoming a *contributing writer*, and during this period the authors can only propose titles. Then, it is possible to become a member of the editorial team comprising 8-9 people (25-30 years, one person is +40, 7 men, 2 women). In this team, there is an editor-in-chief, chief editor, editors, and editors of daily content. On the other hand, for *Zaytung*, there are only two groups. The first is composed of all the collaborators registered on the site, who can propose a whole article or only titles. The second group includes the

Subsection: Politics
Title: "**Handmade Anti-Obama Sign Currently Frontrunner For Republican Presidential Nomination**"
Publication time: 6/08/11 8:00am
Subtitle: "WASHINGTON—According to a Quinnipiac University poll conducted this week, a homemade anti-Obama sign has surged to the front of the 2012 Republican presidential field, emerging as the clear favorite to earn the party's nomination in next year's primaries."
Text under photo: "The sign, which pundits say is nothing short of a GOP "dream candidate.""

editorial team, which consists of five people, 1 woman and 4 men between 25-30 years old. Content producers are generally young students or workers aged between 20 to 30, depending on the interviews. The situation is the same for *Zaytung as* for *El Koshary Today*, founded by two undergraduate student friends, who also accept contributions from ordinary people.

These are communities composed of people from different social backgrounds, mostly middle – upper middle class, mostly "white-collar", mainly leftist, opponents. The founders of *The Daily Mash* (England) say they "help people in offices waste time." A survey reveals that: 65% of their visitors earn more than £30.000 a year, 22% more than £70.000; and 73% are university graduates.

According to *The Onion Media Kit* 2016 statistics, 55% of visitors to the site are between 18-34 years old, 35% earn more than $75,000 and 74% are university graduates. For the same report, the site reaches 15 million unique visitors, 54 million pageviews, and 200 million *Facebook* post reaches per month. As of June 2010, *El Koshary Today* had 1,500 visitors a day, and in May 2015 *Zaytung* had 1 million visits per month. When there are controversial political news, the number of visitors increases to 1 million 6 cents - 1 million 7 cents. Data from *The Onion Media Kit* and also our interview with the founder of *Zaytung* showed us that users and visitors are mostly from major cities. In Turkey, for example, they are mainly from Istanbul, Ankara, and Izmir (similar to the number of Internet users across the country).

Content creators have pseudonyms that are also part of the satirical content and anonymity. Sometimes interviewees want to remain anonymous or fear being "tagged" by state officials, who risk being jailed. *El Koshary Today*'s editors said they preferred to write articles in English so as not to get the attention of the authorities. The other benefit of writing in English is to speak to an international audience.

Conclusion

In this article, we conducted a comparative analysis between three hoax sites in countries where there were mobilizations between 2009 and 2013. We have discovered their disruptive and creative forces, their contributions to "the constitution of a new politics of truth, [...] and change the political, economic, institutional regime of truth production." They criticize the clichés of the information and consumer society, the political figures, the actions of governments, as well as the mass media. They are part of a reinforced participatory culture especially with the penetration of the Internet and version 2.0. The language and cultural codes of these sites are mostly shared by other Internet users around the world, while keeping local specificities. Those who are on the streets and mobilizations and those who produce and consume on the Internet share a big proportion of the same population.

These sites create an opportunity of distancing for the producers and visitors who are both co-producers and co-authors. To understand the field of new media, activist and

artistic projects and to discover their link with everyday life, we need to broaden the scope of our analysis and examine other activist products, actions, and projects.
authors.

References

Manuel Castells, *Networks of Outrage and Hope: Social Movements in the Internet Age,* Cambridge, UK: Malden, MA, Polity Press, 2012.

Michel Foucault, "La fonction politique de l'intellectuel", *Politique*, le 5 décembre 1976.

Jonathan Gray, Jeffrey P. Jones and Ethan Thompson, *Satire TV: Politics and Comedy in the Post-Network Era*, New York & London, NYU Press, 2009.

Jeffrey P. Jones et Geoffrey Baym, "A Dialogue on Satire News and the Crisis of Truth in Postmodern Political Television ", *Journal of Communication Inquiry*, vol. 34 / 3, july 2010.

Jeffrey Gottfried, Katerina Eva Matsa and Michael Barthel, "As Jon Stewart steps down, 5 facts about The Daily Show", Pew Research Center, 2015. Jeffrey Gottfried [et al.], "For some, the satiric 'Colbert Report' is a trusted source of political news", Pew Research Center, 2014.

Demet Lüküslü, "Cyberspace in Turkey, A Youthful Space for Expressing Powerful Disconnect and Suffering", *Wired Citizenship: Youth Learning and Activism in the Middle East*, New York, Routledge, 2014.

Konda, "Gezi Report: Public perception of the 'Gezi protests' Who were the people at Gezi Park", KONDA Research and Consultancy, June 5, 2014.

Naila N. Hamdy, "Prediction of Media Credibility in Egypt's Post-Revolution Transitional Phase", *Global Media Journal*, Spring 2013.

Graham Meikle, "Naming and Shaming: News Satire and Symbolic Power", *The Electronic Journal of Communication*, vol. 18 / 2, 3, 4, 2008.

Tilman Baumgärtel, "Hackers are Artists - and Some Artists are Hackers", interview with Cornelia Sollfrank, September 10, 1998, http://artwarez.org/141.0.html

Robert Phiddian, "Satire and the limits of literary theories", *Critical Quarterly*, 55(3), 44-58.

Megan R. Hill, "Breaking Boundaries| Developing a Normative Approach to Political Satire: A Critical Perspective", *International Journal of Communication*, vol. 7, janvier 2013.

Isabel Ermida, "News Satire in the Press", in *Language and Humour in the Media*, Newcastle, Cambridge Scholars Publishing, 2012.

Limor Shifman and Hadar Levy, "Internet Jokes: The Secret Agents of Globalization?", *Journal of Computer-Mediated Communication*, vol. 19 / 4, Mai 2014.

Tim Luckhurst, "The Daily Mash - satirical, scatological and already profitable", *Independent,* August 16, 2008, independent.co.uk/news/media/the-daily-mash--satirical-scatological-and-already-profitable-899541.html

Tang Lijun and Syamantak Bhattacharya (2011). "Power and Resistance: A Case Study of Satire on the Internet", *Sociological Research Online*, n° 16.

National Public Radio US., podcast "And Now For The Lighter Side Of Egypt's Revolution", June 18, 2012, npr.org/2012/06/18/155134677/and-now-for-the-lighter-side-of-egypts-revolution

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After finishing BA in International Relations at Galatasaray University; and MA at EHESS in Theories and Practices of Language and Arts; continued studying at the University of Paris 8 in Contemporary Art and New Media department.
Realized two researches on the relation between society and cinema from different periods and different regions: "The Representation of totalitarian regimes in the cinema of Central Europe" and "The religious elements in contemporary cinema in Turkey: religious man figures and children".
Also examined individual and/or collective experiences in interactive installations, studying the artwork - 'spectator' relationship in the MA dissertation at University of Paris 8.
Interested in the change of communication, media and digital arts fields in connection to the transition from industrial to post-industrial society. Ongoing PhD thesis "Activism and arts in the web: language as living entity" is an attempt for an aesthetic reading of online *artivist* productions in relation to social movements.

An e-publishing archaeology

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Keywords

Hybrid publishing, post-digital publishing, e-publishing, e-reader, e-book, artists' book, radio, newspaper.

Abstract

The original concept of a publication is to include a limited amount of content in a manageable space in order to be retrievable, mobile and possibly consistent. But as soon as humans have been accustomed to the dimension of the single publication they have tried to overcome its limits and expand it, possibly including as much information as possible in a printed form. Multi-volume works and then encyclopaedias have helped dividing what couldn't be bound in a single still manageable (printed) space, but after the dematerialisation of the publishing space the boundaries has been first blurred and then just vanished, giving room to prototypes, visions and artworks.

History of the infinite publication.

The aim to have more space for content in publications arose during the 20th century, as a consequence of a progressively more dynamic, global and information-based society.

Breaking the boundaries of the print publications was something envisioned by the early avant-garde movements. We can already find a reconsideration of the reading space and experience in the experiments made by futurists with their tin books with metal pages unnumbered and potentially increasable in quantity, like "L'anguria lirica" by Tullio d'Albisola [1]. But it was suprematist El Lissitzky in 1926 first envisioning a transcendence in printed content space "The printed surface transcends space and time. The printed surface, the infinity of books, must be transcended."[2]

The collapse of the printed space.

Among the different attempts to saturate even more the printed space through technological means, there are plenty of "inventions" in the golden mechanical era. One of the most symbolic is one made by an inventor who wanted to minimise the space of print (which is quite similar to what a couple of decades later would have been done by microfilms).

Rear Admiral Bradley Fiske developed in 1922 the "reading machine", a small device allowing to print stuff in very tiny paper space and then magnifying it in order to be read, collapsing the space of print and enhancing its portability. The printed space starts to be pushed to collapse [3].

A widely acknowledged conceptual attempt to overcome it, has been written by Vannevar Bush in 1945 when he sketched a Memex system [4], a kind of enhanced microfilm storage system, which should have drastically reduced the space of publications, making them completely searchable. And in the educational sector in the same years the prototype of a kind of infinite mechanical book has been built by the spanish teacher Ángela Ruiz Robles in 1949. Her "Enciclopedia Mecánica" [5] was meant to connect spellers and drawings, have rolls to display more content in a single space, and wheels to compose sentences, but had also a quite unique "zoom function" in order to let the students focus on a specific part of the content.

The explosion of content space.

Transcending space could also mean not knowing in advance the size of a publication, remaining unknown unless it's printed or the number of pages is displayed (that's more or less how ebooks work now).

The 'radio newspaper' tested during the second half of 1930s was meant to allow a radio listener to print a daily newspaper at home. It was transmitted through dedicated radio frequencies, and then decoded and printed through a specific device integrated into the classic radio receiver of that time.

Then a significant shift in the way of managing the space of content happened: the advent of the retro-illuminated screen. The space of the screen is transcendent as it can be infinitely filled. And with the advent and subsequent familiarisation with screens, the idea of transcendent publishing spaces arrived, first through Science Fiction and then in reality.

In fact already in 1948, Richard Shaver in his "I Remember Lemuria" [6] short novel published in Amazing Stories, wrote about an enigmatic object that he called "a pocket reading machine", and only three years later, in 1951, Isaac Asimov in his short story "The Fun They Had" imagined some "telebooks" [7]. In this story a couple of kids living in 2157 find an old printed book from the previous century, stating at some at some point "what a waste. When you're through with the book, you just throw it away, I guess. Our television screen must have had a million books on it and it's good for plenty more. I wouldn't throw it away."

And two years later in 1961, science fiction writer Stanislaw Lem in his "Return from the Stars" [8] described a new type of books: "the book were crystals with recorded contents. They could be read with the aid of an opton, which was similar to a book but had only one page between the covers. At a touch, successive pages of the text appeared to it."

And just a few years before the Internet would have completely changed the whole mediascape, in 1989, a more defined prototype was described by another science fiction writer Ben Bova, in his novel "Cyberbooks" [9]. Here he tells the story of a young programmer inventing an electronic book device, and how this device disrupts the New

York-centred publishing industry: "...he pulled a gray oblong box about five inches by nine and less than an inch thick. Its front was almost entirely a dark display screen. There was a row of fingertip-sized touchpads beneath the screen." The e-books are delivered by "chip wafers" but what the protagonist was passionately questioning was the potentially uncontainable nature of information: "What you want into the hands of your readers is information — which does not necessarily have to be in the form of ink marks on paper."

Already, in 1968, Alan Kay showed for the first time his Dynabook [10] prototype, never realised but meant for educational purposes, and quite similar to the contemporary tablets until the year 2000s when we'll have the first mass-scale produced e-book readers, and then the Kindle, defined in 2009 by the The Wall Street Journal "the book that contains all books" [11].

Artists' rendering of endless publications.

When we look at the artists' use of publications as artistic medium, there's a prime concept that rapidly emerges, which is thinking about publications as archives, repository of elements, collected, stored and preserved on the publication's page. This concept has been applied since the beginning of the artists' book production.

Already in 1963 one of the first acknowledged modern artist's book, "Twentysix Gasoline Stations", by Edward Ruscha [12], was compiled as a collection of photographs of gasoline stations he encountered during his recurrent trips to visit his parents. The book is used as an archive, storing those pictures as an abstract and personal memory album.

Numerous artists have used the same strategy over time, using the space of the pages to "accumulate" coherent content, becoming then a self-inclusive archive.

But in the current post-digital dimension, the infinite number of online pictures represent a huge visual material for artists. Using publications as archives can even be more ambitious than just a limited edition printed repository. Even more a single book can easily upscale to candidate as a time capsule.

That's exactly what La Société Anonyme, an international artist collective did with their The SKOR Codex [13], whose content (text, pictures and sounds) is binary encoded, with enclosed visual instructions about how to decode it. It's meant to be preserved for the future in a classic 'time capsule' strategy.

So the concept of print publication as archive of the digital has been revamped and expanded. Among the many visual examples there are only a few which use a computational approach with no pictures.

Jacques Derrida in his "Paper Machine" says "Paper is utilised in an experience involving the body; ... so it mobilises both time and space". [14]

A glimpse of the striking paradoxes this mobilisation of time and space can cause now, should be found in this last example of impossible print archive of an iconic endless publication: "Print Wikipedia" is an art project by Michael Mandiberg [15]. He printed 106 of the 7,473 volumes of Wikipedia as it existed on April 7, 2015 and also included wallpaper displaying 1,980 additional volumes. A 36-volume index of all of the 7.5 million contributors to Wikipedia is also part of the project. The table of contents takes up 91 700-page volumes. The printed volume only includes text of the articles. Images and references are not included. The project was shown at Denny Gallery in New York City in the summer of 2015.

Fragmentation of information, Endless structure and self-gratifying loops.

But beyond the publication structure we're accustomed to, there's an ongoing subtle and universal change in the structure and perception of content. The Facebook timeline and its algorithmically designed mix of very personal and very general content, is epitomising the structure of all the other content-based social media (Twitter, Instagram, Pinterest, just to name a few) as well as plenty of major content-based online magazines and platforms where you can scroll down automatically, uploading content that fills up the screen as needed, almost indefinitely.

The crucial premise to this model is the fragmentation of information, its reduction to the so-called "bite-sized content" which facilitates the mechanisms of perceiving a still manageable but in fact endless sequence.

Alex Galloway affirms in his The Interface Effect "This 'reduction' is a necessary trauma resulting from the impossibility of thinking the global in the here and now, of reading the present as historical." [16]

Our reading attitude has changed accordingly, and it has been reshaped not only by this new structure and its constant availability, but also by two type of loops which are based on two respective basic brain mechanisms.

The first belongs to an area of our brain called "substantia nigra/ventral segmental area" [17] which responds to novel stimuli proportionally producing dopamine. Basically the more important the novelty we're exposed (compared to what is stored in our long-term memory), the more we're rewarded with dopamine production.

The second is connected to the "variable interval reinforcement schedule" [18], a behavioural scheme which states how rewarding a subject in a variable interval of time, while he's busy in a repetitive activity, addicts him to go on indefinitely. So basically the endless publishing scheme is addictive because we're biologically totally prone to substantial novelties, and it's even worse when we're rewarded occasionally.

This terrific mechanisms then fits very well with a self-gratification loop, and so with the famine for content in any form, and it somehow justifies the attitude to create social bubbles.

Conclusions.

The tension to overcome the limits of publications towards an infinite one is more vivid than ever, even if it seems more connected to a selfish human ambition then to a real need of communication or archiving.

We already have an infinite amount of content available, even in extremely specialised niches. Redefining the concept of "publication" is then more important than ever, especially understanding the cultural importance of its limits versus the dangers of hard to control loops.

Reclaiming the format of traditional publication, and their "reading experience" is then essential, not only to understand the current formats, but also to create new hybrid formats aimed to technologically expand the historical physical limits, with rewarding social and cultural aims, rather then indulge in addictive consumerism.

References.

[1] Marinetti, Filippo Tommaso *Collaudi futuristi* Napoli: Guida Editori, 1977 p.121
[2] Merz, No. 4, Hanover: Merz-Verlag, July 1923
[3] Science and Invention, v10 #2, New York City: Experimenter Publishing, June 1922
[4] Bush, Vannevar (1945). "*As We May Think*" Atlantic Monthly 176 (July 1945) pp. 101-108.
[5] El Mundo "*Ángela Ruiz Robles: Así funcionaba el precursor del 'ebook' inventado por una maestra española*" ELMUNDO. March 28, 2016. Accessed January 08, 2018. http://www.elmundo.es/ciencia/2016/03/28/56f903ed22601d9e268b4572.html.
[6] Shaver, Richard *I Remember Lemuria*, Evanston Ill: Venture Books, 1948.
[7] Asimov, Isaac *The Fun They Had* in "Boys and Girls page", "NEA service Inc.", December 1951
[8] Lem , Stanislaw *Powrót z gwiazd*, Warsaw: Czytelnik, 1961
[9] Bova, Ben, *Cyberbooks*, New York : T. Doherty Associates, 1989
[10] Kay, Alan C., *A Personal Computer for Children of All Ages* in ACM '72 Proceedings of the ACM annual conference - Volume 1, Article No 1, Boston, Massachusetts, ACM New York, 1972
[11] Marche, Stephen, "The Book That Contains All", The Wall Street Journal, October 17, 2009. Accessed January 08, 2018.
[12] Ruscha, Ed, *Twentysix Gasoline Stations*, Los Angeles: National Excelsior Press, 1963
[13] La Société Anonyme, *SKOR Codex*, Amsterdam: La Société Anonyme, 2012
[14] Derrida, Jacques, Mieke Bal, and Hent De Vries. 2005. *Paper machine*. Stanford, Calif: Stanford University Press.
[15] Mandiberg.com. (2017). Michael Mandiberg. [online] Available at: http://www.mandiberg.com/print-wikipedia/ Accessed 20 Dec. 2017.
[16] Galloway, Alexander R. 2013. *The interface effect*. Cambridge, UK: Polity Press.
[17] Wikipedia contributors, "Ventral tegmental area," Wikipedia, The Free Encyclopedia, https://en.wikipedia.org/w/index.php?title=Ventral_tegmental_area&oldid=819502270 (accessed January 12, 2018).
[18] Wikipedia contributors, "Reinforcement," Wikipedia, The Free Encyclopedia, https://en.wikipedia.org/w/index.php?title=Reinforcement&oldid=819013741 (accessed January 12, 2018).

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City Identity for Durban: Port with a Green Heart

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Abstract

Durban is the busiest port in Africa. Although the harbour is somewhat removed from the consciousness of the residents, it is well-positioned to become a driving force to propel Durban into a Smart City Eco-Port with linkages to the Esplanade that curves around the bay.

The 'Green Heart' title can be anchored by constructing a giant green heart sculpture at the entrance to the harbour (North Pier) that links into the Esplanade. The sculpture will impact the sky-line and serve as a prominent symbol for Durban. Apps, QR codes and electronic signage featured in the KulturWalk and 'Heart2Heart' Route guide people into the harbour area.

The theoretical framework builds on place-identity and place-making that foreground the branding of Durban as Green Heart City and include the residents in taking custody and care of the harbour. Renewable elements of the Green Heart Sculpture Sky Icon include wave power technology and solar film energy.

An accessible Durban Harbour will foster an invigorated identity for the Eco-Port and endear the public with a sense of place attachment. As Durban firms its position on tourist maps, people will identify Durban through branding created by the Green Heart and the spectacular harbour.

Keywords

Smart City-Port, Green Heart Sculpture Sky Icon, KulturWalk, African fantasy, 'Heart2Heart' Route, Green Economy, SanKofa BooK Bridge, city branding, place-identity, placemaking.

Introduction

The centrality of the port is recognised in Durban's isiZulu name, eThekwini (from itheku, meaning "bay" or "lagoon"). In earlier years, Durban harbour was a maze of activity with restaurants at the harbour entrance, a bathing jetty and a vibrant sailing community. Due to restrictions, such features no longer exist. Consequently, the present-day harbour is somewhat removed from the consciousness of the residents.

The citizen-based Green Heart Movement suggests entrenching the harbour in the consciousness of residents by raising the happiness factor through expanded entrepreneurial opportunities. Such activations underpinned by communal elements include storytelling, board games and comic books that pivot around the harbour and environs.

Figure 1. People's Port shaping into an adventurous place to meet, mix and mingle. Future plans for Durban Harbour will ensure that the port is integrated more fully into the daily life of the City. An exciting mix of entertainment and commerce unfolds as Durban takes its place amongst the great cities of the world. ©Sanabelle Ebrahim.

The Embankment is enhanced through iconic features of palm trees, cobblestone footpaths, yachts, bicycles and ecological abundance woven into a visual tapestry referred to as the Green Heart Boulevard. The refreshed public space will see citizens and tourists strolling along the sun-splashed Embankment sporting green felt hearts and interacting with artists, Deaf poets, accordionistas and penny-whistle players. The socially interactive space follows the curve of the yacht basin and evokes a carnival atmosphere.

The name Green Heart Boulevard echoes a new reference to Durban as Green Heart City. The 'Green Heart' title can be anchored by constructing a Green Heart Sculpture Sky Icon at the entrance to the harbour that links into the Esplanade. The sculpture would be visible from aeroplanes and cruise liners as a prominent symbol for the City-Port of Durban. The eco-lighthouse featuring heartbeat pulses and green flashes would place Durban at the forefront of the Green Economy.

Figure 2. Green Heart City Durban beaded pin-on reflecting traditional patterns. ©Mikhail Peppas.

The Green Thrill "Pumping up the Green Beat" creates awareness around the designer structure and heightens interest in eco-arts and skillscraft such as beaded green hearts and BunnyKat folk craft puppets made by indigenous crafters from the Valley of 1000 Hills.

The surrounds of the Sculpture include an events platform featuring a BunnyKat Playzone and Green Heart City Book & Design Boma where the public can contribute and purchase new and used books. A photographic platform and performance arena at the base of the Sculpture Sky Icon couples with a skillscraft trading and demonstration centre to provide viable economic and tourism opportunities. Talks about renewable electricity are featured as part of the eco-arts platform.

Place-Identity

The theoretical framework in support of the Green Heart is informed by place-identity theory and placemaking. A rekindled fondness for the harbour will foster a sense of place attachment as the accessibility expands. Place association will imbue citizens with civic pride and encourage active citizenry around the changing eco-scape of Durban Harbour.

The prospect of place-identity is deeply embedded in the aims and vision of the Green Heart Movement and finds expression across a spread of activations ranging from city branding to cultural tourism and creative thinking that have direct impact in the making of a great city. Place-identity theory emphasises 'the influence of the physical environment on identity and self-perception' (Hauge, 2007, p. 44). City features such as a vibrant arts scene, central library, bookstores, museums, parks, bustling streets, and an efficient public transport system evoke a sense of place and attachment.

Julian H. Steward (1955) defined cultural ecology in his book, 'Theory of Culture Change' as 'the study of the processes by which a society adapts to its environment.' Place-identity and cultural ecology are used in a refashioned form to link City Identity and infrastructure development to the Green Heart Sculpture Sky Icon and related green heart merchandising. At the heart of the initiative is the placemaking potential of the eco-city to inspire citizens to collectively reimagine and reinvent public spaces.

The visual strategy to enrich City-Port ambience includes adventure trips on the narrow-gauge railway line with art and environmental workshops on the Fun Train, a BayWide BookBarge, and SanKofa BooK Bridge spanning the City-Port. The activations transform the Embankment into a bustling locale of choice. City-Port spin-offs enhance hospitality and tourism opportunities in the Greater Durban Area.

A working harbour enveloped in African fantasy is envisaged. The active features of the harbour – giant cranes, storage sheds, shunting yards, trains and carriages – would be culturally-decorated and painted in Zulu beadwork patterns and zebra-stripe graphics. A symbiotic relationship develops that sees citizens and the port in growing unity.

City Identity

Durban lacks a spatial landscape feature recognisable worldwide where tourists and locals can take photos that firmly identifies the City of Durban as the backdrop. The Green Heart Sculpture Sky Icons are set to address this concern.

The northern Heart Sculpture will be positioned at the legendary Blue Lagoon on the uMngeni River. At the opposite end of the beachfront promenade, the southern Heart Sculpture will tower above the entrance to the harbour.

The iconic Sculptures provide a heightened attraction for visitors and citizens of the City of Durban. The Sculpture Sky Icons echo the new reference to Durban as Green Heart City, in a similar light in which New York is known as the Big Apple and Paris as the City of Love.

The landscape Sculptures establish Green Heart City at the centre of a movement around eco-arts and sustainability. The Green Heart is structured at an angle, with a base fashioned from wood, rock and iron – to withstand any storm. Cut glass defines the sculpture with a shape curving up towards the heart's cleavage and allows solar energy to power the LED lighting system.

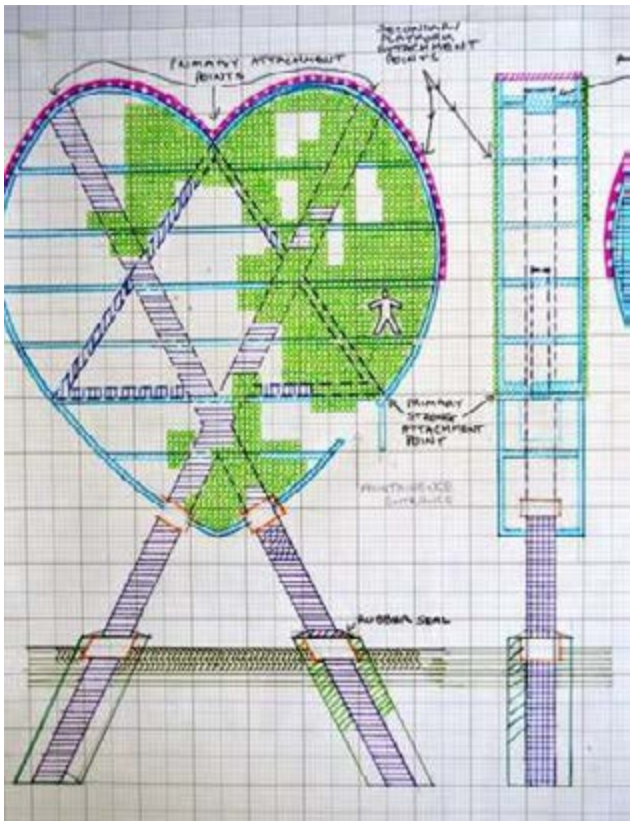

Figure 3. An example of one of the prototype Green Heart electronic art sculpture designs by artist Alex Flett 4DNA (Durban Next Aesthetic). Flett contributes artworks to the Edinburgh Festival and holds exhibitions at Summerhall, Edinburgh. ©Alex Flett.

The theme embodying 'Ancient meets Hi-tech' showcases a design that blends African wisdom with symbols such as the Sankofa bird complemented by a weather vane and original sayings sandblasted on to the surface of the sculpture that include 'Green hearts beat fresher,' 'Take a walk on the Greenside,' and 'Green with Glory'.

Electronic ribbon on the skin of the Green Heart Structure updates the public on various eventings and opportunities, mainly around the Green Economy and how they can contribute to it. Wave power technology and solar film feed into the bulb/battery unit. Any excess electricity can be fed into the Green Hub power system and also into the local grid.

At midday, an audio element booms out 12 heartbeat pulses and at midnight, 12 flashes illuminate the skies. The LED lights will flash a green glow of joy across the harbour, up the uMngeni River, into the sky and out to sea at 12midnight. A 21 heartbeat salute is incorporated for significant events. A sophisticated computer system that controls the above features is installed within the Sculpture Sky Icon. The eco-friendly Structure offers surplus energy into the local and national grid.

Linked activations to the Green Heart Sculpture Sky Icons include BunnyKats and beaded green hearts created by the Woza Moya crafters from the Hillcrest Aids Centre. BunnyKats are endearing doll-sized creatures formed using upcycled materials including cultural fabrics such as shweshwe.

The BunnyKat greenwill ambassadors create publicity in the build-up to the Green Heart Sculptures adorning the Durban skyline. A spin-off fashion label, DNA (Deco Nouveau Afrique/Durban Next Aesthetic) integrates Green Hearts in the design of culturally-evoked local fabrics, jewellery and other street-cred materials.

To catalyse dialogue around the Green Heart as a cultural symbol of Durban, beaded green hearts and BunnyKats can be included in delegate bags at conferences and goodie bags at various eventings. The imposing Sculpture will provide an iconic backdrop to exhibitions and conferences in the City linked to the Green Economy and eco-arts.

Proposed activations include:

- Construction of a Floating Entertainment Platform with a seafood restaurant and mini amphitheatre for arts and poetry performances based on ocean fables. The Floating Platform seeks to reignite a passion for the harbour and surrounds.
- 'Words on Rails' Reading and Writing Safaris using the narrow-gauge railway line that follows the curve of the Durban Harbour from the Point to the Bluff.

The developmental phase includes:

• A Maquette working model of the Green Heart Sculpture Sky Icon.

The Maquette operational model is based on original Green Heart landscape sculpture specifications, featuring solar film and dye solar cells (South African inventions), LED lights, and an audio broadcast facility. The Maquette will harvest energy from the sun. The prototype will be showcased to schools, corporates and at exhibitions. The proposed height of the Maquette is one metre.

• Green Heart Sculpture Sky Icon

A cutting-edge hi-tech innovation that utilises a variety of natural products, renewable energy, and cost-efficient energy storage. Surplus energy is offered into the local and national grid. The Green Heart public sculpture is a greenfield electronic art piece that glows at night and switches on and off automatically depending on lighting conditions.

Much public sculpture remains somewhat remote from the general gaze of the citizen. However, the Green Heart Sculpture Sky Icon is engaging, practical and speaks directly to the minds of people and visitors to Durban.

Figure 4. The BunnyKat cultural icon of Green Heart City Durban and KwaZulu-Natal pops up around the world in the most unexpected places. ©Sanabelle Ebrahim.

The Tower of Text (ToT) experience invites the public to build a Book Tower out of contributed books that will then be gifted to Hospitals such as the Addington Children's Hospital. The future-oriented idea is for each child to receive a book when they leave for home. The ToT is structured as an attempt at the Guinness Book of World Records. A video booth will record visitors' feelings about books.

Attractive prospects of the Green Heart City Invention Framework include:

• The tourism sector (hotels, B&B's, restaurants, tour guides, crafters, souvenir and curio shops) benefits enormously from Green Heart City spin-offs

• Passengers aboard cruise liners are eager to view the Green Heart Sculpture Sky Icon, explore the harbour and visit the Embankment

• Cinema audiences will immediately know the location is Durban as the cameras pan across the cityscape and focus on a Green Heart Sculpture

• The iconic Sculpture puts Durban on the City Identity map.

Green Heart activations raise the profile of Durban on the eco-arts horizon, forefronting the City at the edge of enviro-economics. The citizens of Durban engage with their Green Heart City, and participate in conversations around beaded green hearts, BunnyKats on the Run, and the BunnyKat motto: 'Read Write Draw… X-plaw!'

Beacon-to-Beacon Golden Mile Epic

In line with the planned upgrade of the seafront promenade stretching from the Blue Lagoon at the mouth of the uMngeni River across to North pier at the entrance to the harbour, a route connecting the two points will be identified by marker beacons at each end. The beacons indicate the geolocation and details such as the distance and duration of a scenic walk connecting the marker points. The walk is termed the Beacon-to-Beacon Golden Mile Epic and is supported by an app showcasing restaurants and places of interest along the route.

The marker points provide a convenient and picturesque meeting space for friends and visitors and allow for photo opportunities indicating that the image is taken in Green Heart City Durban. Both marker beacons will have an illustration of the opposite beacon that will encourage people to follow the scenic route. Durban's iconic Green Heart will be engraved on each beacon. Halfway between the two beacons will stand the emblematic sculpture of Durban's very own folk hero comic book character, the BunnyKat. A locally designed shuttle bus depicting images and events along the route will run between the two beacons. BunnyKats, postcards and other Durban merchandise will be available at both beacon points.

KulturWalk

The KulturWalk runs between the Old Fort Warrior's Gate and the Port Natal Maritime Museum. The initiative is supported by the Durban Central Community Tourism Organisation (DCTO). The KulturWalk App charts the sensual landscape of a city. Measurement factors such as happiness, forwardness, evocability, vibrancy, walkability, rhythms, visceral mood, and city image are key elements in shaping and future-fitting a great city.

Digital elements that feature in the central city KulturWalk include apps, QR codes and electronic signage that provide historical and cultural information and outline a route that draws participants into the redesigned Embankment curving around the People's Port. An outdoor screen embedded in the northern Heart at the uMngeni River depicts events taking place at the opposite end of the beachfront promenade and along the 'Heart2Heart' Beacon Route.

Conclusion

A rekindled fondness for Durban Harbour will foster an identity for a Smart City-Port and endear the public with a sense of place attachment. A Smart People's Port enhances community engagement, tourism, leisure, recreation, career and business opportunities. City-Port activations and infrastructure featuring digital elements will transform the Embankment into a bustling locale of choice.

References

Hauge, A. L. (2007). Identity and place: a critical comparison of three identity theories. *Architectural Science Review*, 50(1), 44-52.

Steward, J. H. (1955). *Theory of culture change*. Urbana: University of Illinois Press.

Authors Biographies

Media entrepreneur and film historian **Mikhail Peppas** holds a PhD in Visual Anthropology. He is an Honorary Research Associate in the Faculty of Arts and Design at the Durban University of Technology.

Peppas was awarded the 2017 Simon 'Mabhunu' Sabela Film and Television Award for Lifetime Achievement. Firsts for Africa originated by Peppas include: a film school called the Free Film School and a community television station, Greater Durban Television (GDTV).

He received an Academic & Non-Fiction Authors' Association of South Africa (ANFASA) Grant for the book and documentary project, 'The History of the Moving Image in KwaZulu-Natal.'

Eco-art practitioner **Sanabelle Ebrahim** is based in Green Heart City Durban. She holds a Master of Social Science degree in Cultural and Media Studies. Her interests include Deaf culture, sign language, city identity, placemaking, graphic novels, poetry, board games, shared value entrepreneurship, publishing and sustainable living activations.

EXPANDED RELIEF (HOLOGRAPHIC MEDITATIONS)

Dr Clarissa Ribeiro, Dr Andrew Buchanan, Clara Reial

Independent artist/CrossLAB, College of Arts and Creative Enterprises, ZAYED University, University of Fortaleza/CrossLAB Brazil, United Arab Emirates

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Abstract

The work presented here is a tribute to Hélio Oiticica's radical series of red and yellow 'Spatial Relief' (1960) dialoguing with Moholy-Nag's attempts to create sculptures that would inhabit space without a support. Exploring the concept of 'expanded cinema' (specifically the idea of 'Cybernetic Cinema'), in *'Expanded Relief: Holographic Meditations*' (2018), the illusion of tridimensionality generated by optical physics, in a configuration similar to the Pepper's Ghost technique, expands the algorithmic images produced in processing. The red color subtle differentiations in the illusionary volumes, the geometric irregularity and variation, are resultants from movements and superpositions of shapes algorithmically conceived and animated. The installation is an invitation to meditate on the subtle existence of the image and the role of the observation in creating reality.

Keywords

Algorithmic Design, Generative Design, Processing, Optical Illusion, Animation, Spatial Reliefs, Neoconcretism, Hélio Oiticica, Cybernetic Cinema, Expanded Cinema, Sculpture

Introduction

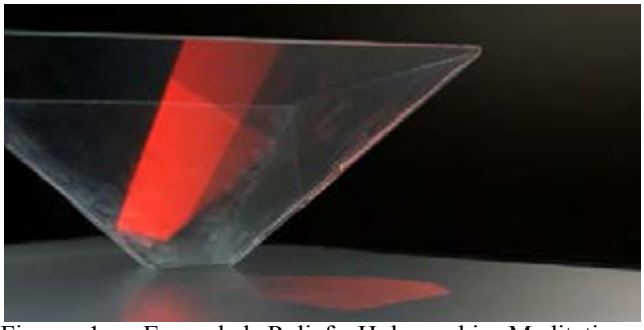

Figure 1 . Expanded Relief: Holographic Meditations (2018). (foto by the author).

The concept of 'Holographic Cinema' discussed by Youngblood (1970) in the chapter 7 of 'expanded cinema' (Part Seven: Holographic Cinema: A New World") is explored in the poetics of *Expanded Relief* (2018) intentionally defining displacement and non-locality as structural ideas for the work. According to Lev Manovich, the book by Gene Youngblood (1970) was influential in establishing media arts as a field of research and practice. One of the main arguments of the author is that expanded cinema is essential for the emergence of a new consciousness. Designed as a meditation on the dichotomy material/immaterial the work proposes reflection about the very nature of reality and perception. The evanescent virtual red sculptures only exists if observed from a certain point of view – moving around the prisms that optically generate and encapsulate the shapes is an alternating dance between appearance and disappearance.

Figure 2 . Hélio Oiticica Spatial Relief (red) REL 036 1959, Polyvinyl acetate resin on plywood, object: 625 x 1480 x 153 mm, 15 kg, Purchased with assistance from the American Fund for the Tate Gallery, Tate Members and the Art Fund 2008, copyright Projeto Hélio Oiticica.

Non-Objects: Transparent Entities

> "The non-object is not an anti-object but a special object through which a synthesis of sensorial and mental experiences is intended to take place. It is a transparent body in terms of phenomenological knowledge: while being entirely perceptible it leaves no trace. It is a pure appearance." (Gullar, 1959 apud Asbury, 2005, p.170)

Figure 3 . Laszlo Moholy-Nagy,Photogram, 1928, Gelatin silver photogram, 28.2 x 35.5 cm (image source: The Moholy-Nagy Foundation)

The 'THEORY OF THE NON-OBJECT' written by Ferreira Gullar, one of the main voices of Brazilian Neoconcretism, was published in 1959, in a historical moment in which the 'Jornal do Brasil', one of the most important newspapers by the time, had the openness to publish in its weekend supplement the representative voices of Brazilian Neo-Concretism. In his text, Gullar defends that, when painting fundamentally abandons representation as in the case of Kazimir Malevich, Piet Mondrian, and their art circles, there is the emergence of a metaphorical space and so it is "[…] the case of establishing the work of art within the space of reality, lending to this space, through the apparition of the work – this special object – significance and transcendence." (Gullar, 1959 apud Asbury, 2005, p.171) At some point Guller mentions Moholy-Nagy and specifically his "[…] attempted to create sculptures that would inhabit space without a support." (Gullar, 1959 apud Asbury, 2005, p.172) having, as pointed by the neo-concrete theorist, the intention of eliminating weight from sculpture, affecting, this way, a fundamental characteristic of an object. According to Walter Gropius, close friend of Laszlo, his greatest effort as an artist was devoted to 'the conquest of space' in Gropius words, venturing into "[…] all realms of science and art to unriddle the phenomena of space and light" in the most diverse areas, he incessantly attempted to "[…] interpret space in its relation to time, that is, motion in space."(Gropius, 1959, p. viii).

Holographic Meditations

In 'Expnded Cinema' (1970) Gene Youngblood mentions that techniques known to the ancient Egyptians and practiced by magicians for centuries may provide the means for a future system of large-scale, real image holographic movies as 'the Illusion of the rose in the vase" that uses a

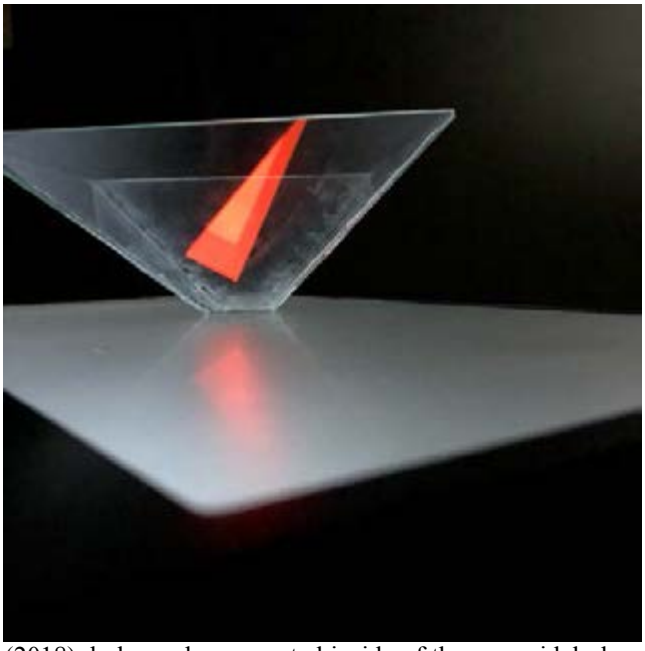

Figure 4. Expanded Relief: Holographic Meditations (2018), holography generated inside of the pyramidal glass prism. (foto by the author)

lens, a concave mirror, and pinhole light source to transpose illusionistically an object into three-dimensional space in full color, and is commonly used in Japan to project tiny three-dimensional images of human performers onto miniature stages of puppet theatres – the actual persons are beneath the stage floor.

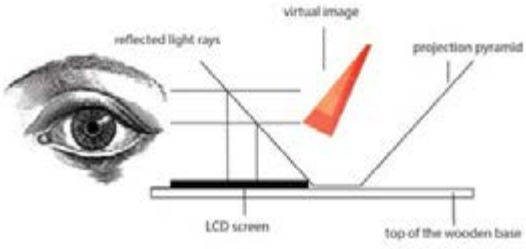

Figure 5. Expanded Relief: Holographic Meditations (2018) diagram (diagram by the author)

Recalling and at the same time expanding to an extreme an evanescence of the object, deeping the explorations and intentions of both Moholy-Nagy and Hélio Oiticica in his series Spatial Relief (red) REL 036 1959 (Polyvinyl acetate resin on plywood), the red moving shape is floating inside of a small glass pyramid on the top of a LCD screen of a tablet where the algorithmically generated motion picture

emerges, as in the surface of a digital lake, up to the air, floating, levitating, free from the framed materiality of the computer screen.

The work was exhibited in April 2018 at the LIP Gallery, University of Fortaleza, in an event related to the LASER talks Fortaleza. In a corridor measuring approximately 5 x 1,5 meters, 3 cubic wooden bases are positioned having on the upper surface an LCD screen installed playing the generative animation. On the top of the screen, the glass prisms are placed. The audience is invited to stay close to the pieces and quietly observing the immaterial moving sculpture – evanescent color floating in the dark.

Matter and energy

Expanded Relief (2018) is a work under construction and, despite the subtlety and simplicity of the first version here shortly presented the intentions of the artists is to deep the conceptual incursions and poetically explore the pop culture constructs and imaginary related to the optical phenomena of holography. Professor Pier Luigi Capucci in his paper "The case of holography among media studies, art and science" (2011) points that "Holography suggests a new visual universe within a culture where the visual simulation is the most effective communication system; and it let us reflect about the need for a more comprehensive definition of "image"."(Capucci, 2011). Capucci believes in future scenarios where future images will be holographic and the communication be experienced and shaped as "[…] a delicate balance between presence and absence, immediacy and remoteness, materiality and immateriality, matter and energy." (Capucci, 2011)

References

Asbury, Michael (2005) Neoconcretism and minimalism: on Ferreira Gullar's theory of the non-object. In: Cosmopolitan Modernisms. InIVA / MIT, pp. 168-189

Capucci, Pier Luigi. The case of holography among media studies, art and science. Technoetic Arts: A Bournal of Speculative Research. Volume 9 Numbers 2 and 3. Bristol, UK: Intellect Ltd, 2011.

Gropius, Walter. Introduction. In: Moholy-Nagy, Sibyl. Moholy-Nagy: Experiment in Totality. Cambridge: MIT Press; 2nd edition (October 1969)

Manovich, Lev. (2002) Ten Key Texts on Digital Art: 1970–2000". Leonardo. 35 (5): 567–569.

Moholy-Nagy Foundation (2018). Art Database. Retrieved from: http://moholy-nagy.org/art-database-gallery/

Tate Gallery (2018) Hélio Oiticica Spatial Relief (red), 1959, REL 036 1959, Polyvinyl acetate resin on plywood, object: 625 x 1480 x 153 mm, 15 kg. Retrieved from: http://www.tate.org.uk/art/artworks/oiticica-spatial-relief-red-rel-036-t12763

Youngblood, Gene. (1970) Expanded Cinema. New York: E. P. Dutton & Co., Inc. 1970.

Authors Biographies

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Andrew Buchanan holds a PhD in Creative Media from RMIT University (*Plasmatic: Improvising Animated Metamorphosis*) focusing on metamorphic animation and the production and reception theories of improvised animated images. Additionally, he holds a Master of Arts in Animation and Interactive Media and a Bachelor of Industrial Design. Over the last decade, his work has been shown exhibited at the Sydney Film Festival, Experimenta Media Biennial, The International Symposium on Electronic Art, The National Gallery of Victoria, White Night, and at other national and international animation and projection art events.

Clara Reial is a 3rd year student doing a bachelor of architecture and urban planning at the University of Fortaleza. Since 2015 Clara joined the Crosslab research group and has been collaborating on projects in the intersections between art, architecture, science and technology. In 2017 she served as a Junior Teacher Assistant for Professor Clarissa Ribeiro's classes on Experimental Design Strategies at UNIFOR and had published papers in international and local conferences documenting and discussing the didactic strategies she helped implementing.

Tributes to Francisco José de Caldas: New expeditions and hybrid practices in Art and Science

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Abstract

This paper consists of a biographical presentation of the polymath Francisco José de Caldas and two programs inspired by him that aim to bridge art and science practices. Caldas mastered several disciplines from biology to journalism and was a key figure in Colombian independence more than 200 years ago. The University of Caldas is leading two programs that are inspired in Francisco José de Caldas legacy to promote hybrid practices and integrative thinking. Exposure to multiple disciplines with collaborative tools can help not only individuals but also teams to generate hybrid practices that integrate complex broad knowledge.

Keywords

Hybrid practices, polymath, Francisco José de Caldas, art and science, expeditions.

Introduction

2018 is the year of the 250th birth anniversary of the scientist and humanist Francisco José de Caldas, who pioneered expeditions to American territories at the beginning of 19th century. Caldas was considered a polymath because of his broad knowledge of art, technology, biology, astronomy, and geography. Caldas, similarly to Leonardo da Vinci, Albert Einstein, or Benjamin Franklin, had extensive abilities to make hybrid connections between arts and sciences. He served in expeditions to territories with permanent innovations and the creation of complex devices. This paper is a brief description of Caldas' hybrid practice and two proposals of integrative knowledge production in the province of Caldas, Colombia called "Caldas: Expedition 21st Century" and "Science Center Francisco José de Caldas."

There is a great deal of recent interest in hybrid practices and integrative knowledge. For instance, the international STEAM movement, which proposes to include art in STEM (science, technology, engineering, and mathematics) initiatives (see Malina, Strohecker, & LaFayette, 2013). This interest is usually coupled with the criticism to the reductionist thinking in sciences. Understanding history and achievements of polymaths should shed light on how to promote transdisciplinary thinking and support and help to develop programs that focus on hybrid practices.

Francisco José de Caldas

Caldas, as a scientist, military official, journalist, and writer, contributed not only to discover immense Colombian natural resources, but also fought for national independence. Today, he is remembered by his direct participation that led to the independence on July 20th of 1810. Caldas helped to build a memory of the causes and cruelties of conquest and colonization. In 1816, Caldas was captured by Spanish royalist Pablo Morillo, who ordered his execution.

Caldas had a constant interest in critical thinking and science. He contributed to the first studies in geography and engineering. He was the first Colombian cartographer and critical studies about climate, military science, economy, politics, and history. Caldas invented the hypsometer, which is a thermometer that measures the attitude depending on the boiling point of water. He used this device to elaborate an atlas of the New Kingdom of Granada, which included details such as the geography of the Magdalena river (the longest in Colombia) and the altitude of the Tolima snow peek.

Francisco José de Caldas worked in biology, astronomy, and engineering. He participated in the Royal Botanical Expedition to New Granada as a biologist and collected more than 5,500 flora species. He also was in charge of the National Astronomical Observatory in Bogotá, that was built by the Spaniard scientist José Celestino Mutis. Caldas led the observatory to become a science center for astronomy and geography. He is considered the father of Colombian engineering because of his works after the independence.

Late Caldas was politically active, a military and a journalist with a nationalist commitment. Caldas used the observatory to facilitate political meetings of other pro-in-

dependence figures such as Camilo Torres and Antonio Nariño. Later he was a senior officer with engineering responsibilities in the army and was the editor of the first official newspaper.

Two recommended biographies of Francisco José de Caldas are in the works of Jaramillo Gonzales (2010) and Plazas Galindo et al. (2017). Caldas' execution was widely lamented and his legacy has been recognized permanently through Colombian national history.

Caldas: Expedition 21st Century

In Colombia, there have been several tributes to, as known in the nation, 'savant' Caldas, but unnoticed by many. The province Department of Caldas and its main higher education institution, University of Caldas, honor Francisco José de Caldas with their names. In 2018, it is the 250th anniversary of Caldas birth; to pay tribute, the university has proposed the program "Caldas: Expedition 21st Century," which aims to study the contemporary status of regional science, territory, society, art, and culture using similar approaches and routes defined by the savant Caldas more than two centuries ago.

This Caldas new expedition is a collaborative program for learning, outreach, and research for the region. One of the goals is to foster collective construction with spaces for discussion such as think tanks and forums. In the program also participate other public and private institutions are invited. The core values of the program are inclusion, multidisciplinary work, educative impact, and connection with society. The program encourages interactions between academics (students and faculty) and local people and institutions to foster knowledge exchanges and collaborative work.

The core areas of the expedition are broad and represent the traditional strengths of the university:

- Agricultural sciences, biodiversity and natural resources
- Natural and physical sciences
- Engineering, technology, and development
- Social innovation
- Social and juridical sciences
- Economy and society
- Design and culture
- Memory and heritage
- Education and pedagogic practices
- Climate change
- Peace

In this scenario, it has been expected that several projects are proposed with a broad goal to identify the inventory of resources in the region. A representative case is an expedition to the Florencia Wilderness located in the municipality of Samaná. This place preserves a large amount of biodiversity and needs conservation policy for its protection. The wilderness is a hydrological resource that is endangered by new inhabitants (see Figure 1). It includes several streams that later turn into rivers that feed La Miel dam or provide a source of drinking water for the region.

Figure 1. Hydrological resources in Florencia Wilderness

One of the requirements of the projects is to define a georeferenced database of the findings. This will help to protect the intellectual property of material and immaterial assets. In the Florencia Wilderness expedition, the participants studied four groups of species: Periphyton, plankton, bacteriological and aquatic macroinvertebrates (see figure 2). Biologists, artists, engineers, and museographers study 75 amphibian species, 278 bird species, and 65 mammal species. From these studies, they have done digital cartographies, critical curatorship, algorithmic analyses, and multimedia musical compositions. These works are exhibited in the University Museums Center and are promoted with the community in collaborative networks.

Figure 2. Species in Florencia Wilderness

Caldas: Expedition 21st Century, beyond a program, seeks to join common interests and goals. The spirit is to develop an appropriate territory for the inhabitants and nurture children and youths to learn about the region of Caldas in a cooperative and interactive environment.

Science Center Francisco José de Caldas

Another program that pays tribute to savant Caldas is the Science Center Francisco José de Caldas. The program is part of a national policy that aims to create science centers that facilitate social appropriation of science and technology. The goal of the center is to enable citizen participation in the scientific culture. This will be a space for exchanges between artists, scientists, and citizens using collaborative strategies supported by cases directed to solve local challenges (see figure 3).

Figure 3. Representations of the Science Center

The center is based on the concept of 'maker culture,' which is related to the development of technical and scientific skills for general citizens and, at the same time, creative thinking and concrete problem solving are at the center. Papavlasopoulou, Giannakos, and Jaccheri (2017) argued that 'maker' activities are a broad and constructivist way to acquire knowledge where the learner is in the center of the process (p. 58).

Inspired by the polymath Francisco José de Caldas, the Science Center is a program that seeks to integrate physical, scientific, artistic, and cultural practices with democratic access. The outcomes are expected to be based on hybrid practices.

Conclusion

Legendary figures such as Francisco José de Caldas inspire the pressing demand for integrated and transdisciplinary knowledge and actions. Broad critical thinking is the key to understand historical and contemporary resources and needs of any region as a basis to solve social and environmental complex challenges we are to address in the near future. The savant Caldas follow both scientific and humanistic paths that are and will be more pertinent.

The goal is not centered in nurturing more contemporary polymaths, which could be challenging. The ability to be creative in more than one disciplinary area is rare, but not impossible (Kaufman, Beghetto, Baer, & Ivcevic, 2010). Yet, exposure to multiple disciplines with collaborative tools can help not only individuals but also teams to generate hybrid practices that integrate complex broad knowledge. Caldas is our local inspiration for these merged art and science practices, we pay tribute to him.

References

Jaramillo Gonzales, Daniel (2010). Diario de la luz y las tinieblas. Francisco José de Caldas. Bogotá, Colombia: Ediciones Uniandes

Kaufman, J. C., Beghetto, R. A., Baer, J., & Ivcevic, Z. (2010). Creativity polymathy: What Benjamin Franklin can teach your kindergartener. *Learning and Individual Differences*, *20*(4), 380–387. https://doi.org/10.1016/j.lindif.2009.10.001

Malina, R., Strohecker, C., & LaFayette, C. (2013). *Steps to an Ecology of Networked Knowledge and Innovation: Enabling New Forms of Collaboration among Sciences, Engineering, Arts, and Design* (SEAD). MIT Press. Retrieved from http://www.mitpressjournals.org/page/NSF_SEAD

Papavlasopoulou, S., Giannakos, M. N., & Jaccheri, L. (2017). Empirical studies on the Maker Movement, a promising approach to learning: A literature review. *Entertainment Computing*, *18*, 57–78. https://doi.org/10.1016/j.entcom.2016.09.002

Plazas Galindo, Raúl, y otros (compiladores) (2017) Caldas. Personalidad de un sabio. Bogotá, Colombia: Editorial UD.

Posthumanism, Technology, and Monstrous Life Forms

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Abstract

This article aims to discuss and argue about the tangled and intricate relations between posthumanism and technology in the attempt of elaborating upon the creation of new monstrous forms of life within the framework of bioart. By dwelling on works by Oron Catts and Ioana Zurr, the article seeks to re-think posthumanism's species inclusiveness as a scientifically and technologically determined trait and to emphasize the role of technology in decentering the human-normative understanding of life. Nevertheless, using examples pertaining to the artistic field, the paper implicitly re-phrases the artistic enterprise from the point of view of a theoretical, lab-researched based endeavor dictated by accelerated biotechnological changes.

Keywords

posthumanism, mutant life forms, biotechnology, hybridization, bios, zoe, human animal, non-human animal, monstrous creatures, bioart.

Introduction

In 2014, Pierre Huyghe released his most recent film entitled Human Mask, in which the surrounding exteriors, depicting a deserted and shattered town, were shot in a post-Fukushima exclusion zone, with a camera attached to a drone. The main character, a bizarre creature, wearing a Noh mask, is shown wandering in an abandoned shelter, replicating uncanny human gestures and repeatedly touching its long dark hair with its thin, claw fingers. It is in the light of this disturbingly hybrid, monstrous creature – half animal, half cyborg, half ape, half machine – that I intend to unfold the breach between species within the posthumanist framework and to bring forward the role of technology in forging this misty un-bordered territory. Because, while cultural representations of the future usually envision, in terms of automation, the exchangeable chemical bond between humans and cybernetics, the animal is still described as the outermost edge of the human, and, from this point of view, afflicted with exclusion and subordination, and sentenced to social and language deprivation even in postulating narratives about possible, preferable futures. However, since Darwin, as Christoph Cox legibly avers, "we are less inclined to stress out the links to the divine and more likely to acknowledge animals as our kin." (Christoph Cox, 2016: 115) In *On the origin of species*, Darwin advocates for the elimination of boundaries and hierarchies as a prime principle in theorizing evolution. If species may (statistically) combine in countless shapes and manifestations, that is due to the fact that the evolutionary process is conceived as a series of variations and mutations through which the other is re-produced and brought into appearance. Evolution is "a descent with modification," it follows "the play of repetition and difference" (Elisabeth Grosz, 2005: 19), designating a mechanism grounded on mutant recursive replication. The greater the proliferation, the more the variation is able to enact new monstrous forms of life, especially when "monstrosities cannot be separated by any clear line of distinction from slither variations." (Charles Darwin, chap. I). Every embryo or larva is an instance of species mutability, every cell, trunk or molecular chain's bifurcation represents an open-ended becoming.

Monstrous Life Forms

The non-human animal is not only the absolute alterity, "the wholly other they call animal" (Jacques Derrida, 2008: 11) or – as Agamben, following Linnaeus' footsteps, reasons – an anthropomorphous machine unable to recognize itself as human yet trough which, like in an optical device, the human animal should be able to foresee itself (Giorgio Agamben, 2004: 26), but foremost, as its human kin, a transitional form of life, already transmuted and always transmuting. For, rather than denominating an essentialist, teleological and finite unit within nature, each living organism designates an ongoing actualization of a virtual field of possibilities. The nineteenth-century French biologists Etienne and Geoffroy Saint-Hilaire, along with Camille Dareste, who founded the science of teratology (the study of monsters) annulated the opposition between 'normal' and 'abnormal' creatures by refusing to standardize one unique variation of the unlimited string of variability an organism can undertake. "It is impossible", Dareste wrote, "to establish in any definitive way the limits of the possible." (Camile Dareste, 2016: 120) Instead of following the path of identical replications, the algorithms of natural selection operate on infinite data, culling from and crossing incentive, stimulative and mutable species. The monstrous, mutant creature is therefore a morphological actualization, no different than, the same and on par with any other, of the vast virtual continuum which is matter.

Nevertheless, the impossibility to schedule, predict and restrain the dynamics of the evolutionary lines of flight

proves to be even clearer when technology slithery enters into the question. Not only does technology determines an explosive of computer-based devices capable of parsing and manipulating the DNA structures of living organisms, but it also gives rise to the number of lab experiments, generating cellular and genomes' intersections, hybrid life forms and genetically modified organisms. Even though all these ascending advances in both bio- and nanotechnology and in genetic engineering may undoubtedly lead the way towards a potential discharge of the material body, resolving it to a set of flickering signifiers running on a computer screen (Katherine Hayle, 1999: xiv) or to a sort of archives of data (Catherine Waldby, 2000: 6), facing the emergence of digital ontology, they equally give birth to a zone of indeterminacy, characterized by interspecies inclusiveness, beyond the taxonomic limitations of genus, class, breed and even flesh embodiment. Changes registered in the politics of descent are also converting the politics of selection. In the era of postindustrial, techno-capitalism, nature, in the way Darwin pictured it, fled its dominant role in dictating species selection. Modification and mutation are not anymore the outcome of a structural interplay within nature, but rather intertwined products of a naturalcultural selection, following the logics of symbiogenesis, to use Dona Harraway's terms. Schooled in the westernized techno-cultural discourse, posthumanist living organisms are being shaped and saturated by information sciences and technological protocols. They state the encounter between historical evolution, philosophy and techno-biological sciences, making permeable the discourse of and on difference(s). As Rosi Braidotti consideres, taking into consideration the etymological heritage, monsters represent "the in between, the mixed, the ambivalent as implied in the ancient Greek root of the word *monsters*, *teras*, which means both horrible and wonderful, object of aberration and adoration." (Rosi Braidotti, 1994: 77) They negotiate the space of confluences and convergences, displacing the rational thought to nomadic frames on its approach towards the (mal)formation of the body.

In an attempt to overcome the sovereignty of anthropogenetic and anthropomorphic perspectives, the posthuman monstrosity, indebted to its computer simulated siblings, appears as a contaminated body (Judith Halberstam, Ira Livingstone, 1995: 3), articulated with both artificial intelligent systems and genetic recombination of codes and materials. It's, therefore, a question of twining software and wetware, of mediating between the two not with the aim of re-affirming the kith and kin of machines, animals, plants and minerals, but first and foremost with the purpose of stating the interspecies condition of present and future life forms, pleading for a transition from *bios* to *zoe*, and elaborating upon the role of contamination. For Anna Tsing, the key to surviving the industrial ruined landscape of the future stands in collaboration and contamination, which are mutually dependent. "Collaboration means working across difference, which leads to contamination" (Anna Tsing, 2015: 29); without it, extinction, not germination, lies ahead in somber, dusky colors. Relational contamination creates new life forms, transforming them into the process. Each encounter generates genetic and genealogical re-locations and paves the way for monstrous contagions to occur. Collaboration, contamination, contagion – all, in a synonymic organic relation, allow us to imagine the future, by encouraging the re-production and re-enactment of life from and in hybrid associations, pointing towards the never neutral intervention of technological assistance and underlining the need to expand the compass of life itself, renegotiating the relation between *bios* and *zoe*.

From *bios* to *zoe* to *techne*

The dualism between *bios* and *zoe*, which the posthumanist attempt of species inclusiveness doesn't hesitate to conjure, has a long turbulent history that can be easily tracked down to the Greek etymology of the term life. Hence, even though they both share a common root, their meaning as well as their degree of socio-political and ge(ne)ological inclusion differ: while *zoe* names the simple fact of living common to all living beings (animals, plants, humans or gods), *bios* rather indicates the form or way of living proper to an individual or a group (Giorgio Agamben, 1998: 4). Thus, the gulf between the two grows from the kind of life the two engage, since *zoe* generally regards the existence of a living being, without drawing a line of hierarchical demarcation or natural circumscription, and *bios* indicates a qualified, particular type of life, adjusted to the political norms and tied to *logos*. Moreover, besides delineating the deprivation of participating in the politics of the state, *zoe*, implicitly, names the deprivation of any form of agency over their own life inside the citadel. It is, thus, a question of exclusion through non-identifying and non-ratifying their function as socio-political actants in the dynamics of working out the power and in building the etatist structure. Devoid of juridical consent, *zoe* qualifies *la vida nuda*, transgressing any form of conceptualization and incarceration attempted to be designed by the laws of social contingencies, being, from this point of view, opened to mere potentialities. If *bios* is attributed to the civic, politically and (falo)logocentrically organized life, which inevitably dwells into the *polis* and which accommodates the only living being who possesses institutionalized language, that is the human animal, then *zoe* corresponds to the language deprived living beings, to the vibrant "vital materiality that flows through and around us" (Jane Bennet, 2010: x), naming the "mindless vitality of Life carrying on independently of and regardless of rational control" (Rosi Braidotti, 2006: 37), the bare life to which the human animal responds by exhibiting an exclusive inclusion. *Zoe*, finding itself in an inclusive opposition with bios, validates nonhuman agencies and ratifies a shared space of inbetweeness where formally different life forms ally and collide. However, transitioning from *bios* to *zoe*, a correlated third term, *techne,* occupied by technology, enters the fastidious task of questioning our definition of (natural) life. In this triad landscape, technology emerges neither as an unbiased

force, nor as a prosthetic resort, but as an immersive, constitutive, always present, simultaneously old and premature agent, which is increasingly transforming the domain of life, revealing it as a genetic engineered interface between human and non-human animals and machines. Life opens itself as a biological matter transmogrified and transmuted on the process, entering in contact with different, stratified fields of the high-technological capitalist culture, resembling more and more to a semi-automated assemblage.

The re-conceptualization of *zoe* through technology in bioartistic practice

This (re)opening to zoe – an alternative, irrational, non-discursive face of bios – by embracing both technology and science as essential agents in the process, represents a move forward to a more radical, post-antropocentric approach, that artists like Oron Catts and Ionat Zurr, working in the field of bioart, share. Co-founders of Tissue Culture & Art Project (TC&A) and academics of SymbioticA artistic research laboratory, Catts and Zurr are interested in using tissue technologies as a medium for artistic expression and production, as they are investigating the interaction between different human and especially non-human organisms with the purpose of enunciating a new class of semi-living beings. The semi-living is a term coined by the two artists, in 1996, and since then it has been used for designating no medical usage living tissue constructs that are grown out of tissue(s) pertaining to more complex organisms, and that are developed and maintained alive with the aid of technological intervention and artificial support. By dwelling on the understanding of biology not as a merely analytical discipline, but rather as engineering, in the tradition of the German biologist, Jacques Leob, known for his famous experiment on artificial parthenogenesis, the two artists envision life as a raw material to contestably design. Catts and Zurr are working with regenerative medical technologies that are currently being used in medicine for the creation of neo-organs or body spare-parts, such as the infamous human ear attached to a laboratory mouse. However, instead of being grown into a pre-established form, with a fixed medical purpose, and implanted into a host body, their three-dimensional tissue constructs are aimed to be integrated into artificial, techno-scientific bodies, creating monstrous semi-living beings, which are "biologically and psychologically non-functional," (Eugene Thacker, 2005: 309) and which occupy that "ambiguous, intermediary zone between subject and object, a sort of tissue actants" (Idem), mediating between fully biological and excessively artificial life forms. Art is not anymore produced in the studio, but in the secured, aseptic environment provided by the fully equipped laboratory, where science trained artists are working with applied technologies for manipulating stem cells, genotypes and in vitro tissues, participating in a collaborative bio-tech revolution. Moreover, using fragments of biomass that grow like art objects outside of the organism from which they originated, Catts and Zurr are questioning the ethics and economics of life reproduction within the framework techno-science acceleration. *Victimless leather* (Figure 1) – a prototype of a stitch-less jacket, grown from cell cultures into a layer of tissue supported by a coat shaped polymer layer – or *Pig Wings* (Figure 2) – a three Pterosaurs-shaped set of wings made out of pig mesenchymal cells (bone marrow stem cells) and grown over/into biodegradable/bioabsorbable polymers for approximately nine months inside a rotary cell culture bioreactor - are both critically acknowledging and responding to a constantly ascending culture of life fetishization and commodification, from stem cell and tissue banking to disembodied cuisine and entertainment business. The lack of rhetorics and politics employed to elaborate on these semi-living beings – neither inert objects, nor autonomous, self-sustaining organisms – meets a yet too human-centered approach towards the posthumanist present, which is still leashedly captive to an anthropocentric system of signs.

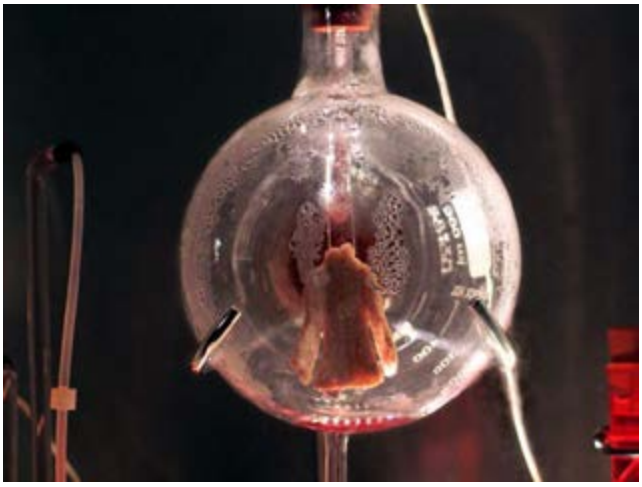

Figure 2. *Victimless leather*, photo from TC&A webpage

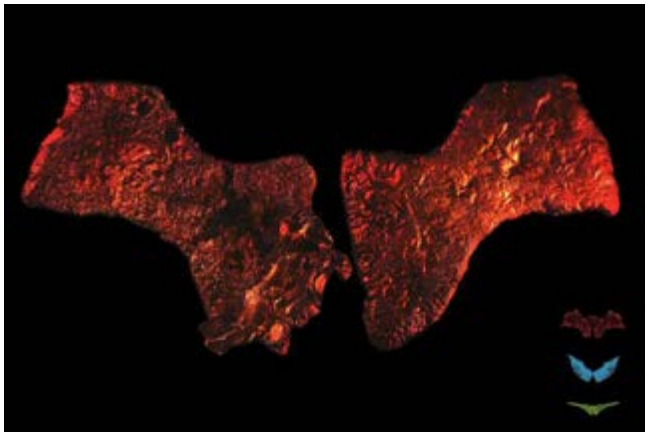

Figure 1. *Pig Wings*, photo taken TC&A webpage

Our tendency, as humans, to reduce these and other monstrous creatures – be they anatomically and genetically modified organism, requiring technological assistance or cyborgs, combining (synthetic) flesh, software and bit to bit articulation – to agential origins, depriving them of social and political agency, confirms the persistence of an exclusivist utilitarian ethical perspective and the prevalence of political and ideological agendas in considering

the teratological creatures, which nevertheless embody our akin other. Instead of manifesting an extraneous tendency of dismissiveness, based on inherited anthropocentric beliefs, we should recognize them as our biotic, abiotic, automated, semi-living collaborators and co-laborers for a future community to come. We are all mutants and in teratology we confide - don't be afraid to transmute!

Acknowledgements

This work has been supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS/CCCDI – UEFISCDI, project number PN-III-P2-2.1-53BG/2016.

References

Agamben, Giorgio (1998). *Homo Sacer. Sovereign Power and Bare Life*, Stanford: Stanford University Press.

Agamben, Giorgio (2004). *The Open: Man and Animal*, Stanford: Stanford University Press.

Bennet, Jane (2010). *Vibrant matter. A political ecology of things*, USA: Duke University Press.

Braidotti, Rosi (1999). *Nomadic Subjects: Embodiment and Sexual Difference in Contemporary Feminist Theory*, NY: Columbia University Press.

Braidotti, Rosi (2006). *Transpositions. On nomadic ethics*, Cambridge: Polity Press.

Cox, Christoph (2016). *Of Humans, Animals and Monsters*, in Ramos, Filipa (Ed.), *Animals*. *Documents of Contemporary Arts*, London/ Massachusetts: Whitechapel Gallery/ The MIT Press, 114-123.

Darwin, Charles, *On the Origin of Species* Retrieved from http://www.literatureproject.com/origin-species/Origin%20of%20Species%20-%206th%20Edition_2.htm. (Last accessed 9 January, 2017)

Derrida, Jacques (2008). *The Animal That Therefore I Am*, New York: Fordham University Press.

Grosz, Elisabeth (2005). *Time travels. Feminism, Nature, Power*, Australia& New Zealand: Allen & Unwin.

Halberstam, Judith, Livingstone, Ira (1995). *Posthuman Bodies*, USA: Indiana University Press.

Hayles, Katherine (1999). *How we became Posthuman? Virtual Bodies in Cybernetics, Literature, and Informatics*, Chicago & London: The University of Chicago Press.

Saint-Hillaire, Etienne, Saint-Hillaire, Isadore & Dareste, Camille, drawn from Cooper, Melinda (2014). *Regenerative Medicine:Stem Cells and the Science of Monstrosity* and quoted in Cox, Christoph, *Of Humans, Animals and Monsters*, op.cit.

Thacker, Eugene (2005). *The Global Genome, Biotechnology, Politics and Culture*, Cambridge: The Mit Press.

Tsing, Anna, (2015). *The Mushroom at the End of the World. On the Possibility of Life in Capitalist Ruins*, Princeton & Oxford: Princeton University Press.

Waldby, Catherine (2000). *The Visible Human Project*: *Informatic Bodies and Posthuman Medicine*, London: Routledge.

Author Biography

Anca Bucur is a Bucharest-based poet and performance artist, co-founder at frACTalia press, and editor at InterRe:ACT magazine. Being interested in techno-culture and bio-technological framings of future communities, she often works with text, images, sound and computer software. In her poetry she makes use of post-conceptual techniques, experimenting with different types of language(s) and discourses. She studied literary theory at the University of Bucharest from where she holds a MA, and currently she is a research assistant at Human Language Technology Center and a Ph.D. candidate with a thesis researching Wittgenstein's *traces* in literature and art.

Sound-Art and the Game Paradigm

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Abstract

This paper focuses on a the production of a digital artwork for mobile app (IOS). The work is titled "TechnoSpaces" and it is formatted as a digital game. The paper looks at the process of building the work and some of the implications and possibilities of such processes. Key findings of the research are related to the construction of an artist's framework for mobile artworks. Various forms of creative sound manipulation and synthesis can be structured into mobile games with the right approach and vision.

Keywords

Digital art, Sound art, Music, Programming, Swift, Game, Mobile development.

Introduction

Sound-art, art, music and computer programming: these elements are the focus of the present paper. They are not separated here, one from the other. In the work of many producers (artists) all of these elements are present. The ratios may change but the basic building bricks are there. Are we artists or musicians? Writers or programmers? Many 21st Century producers are all of these things.

The present author is a composer and musician. As a musician one performs, one improvises, one composes. In many ways various other, "non-musical", cultural elements become part of the musical practice. Many musicians incorporate writing (text) and visual artistry into their activities. The manipulation of digital sound and image through programming is another important aspect of the modern musician's work. Thus one becomes perhaps, more generally, an artist.

As an artist one is constantly on the lookout for a way to develop and enhance one's métier. The present paper describes a foray into the evolution of artistic process as experienced by the artist. The focus of the paper is an artwork / game that the author is producing. The work is being done as a mobile IOS application in the Swift language.

Other researchers have looked into the connections between games and art or games and music (see Collins 2017). MoMA has acquired some games in its collection including Pac Man (Antonelli 2012). It is however a somewhat irksome topic for some (Zimmerman 2014). Yet as musicians and artists the game paradigm is of interest as it offers a wealth of frameworks and techniques that can be plundered.

The title of this paper is "Sound-art and the game paradigm". This title reveals that the focus here is upon a kind of sound-art that is, in some way, organised with or related to the game paradigm. The paper describes an experiment into the use of some game-specific components in the production of a piece of sound-art. The work that is being produced is on one level sound-art in the sense that it involves human interaction in relation to music and synthesis. It is also from another perspective an IOS game.

The paper will describe the process in its various parts. Let us list them here. (1) Make a piece of sound-art for mobile device. (2) Use various programming languages to bring this to fruition. (3) Make use of the game paradigm as a template for the work and programming.

In what follows I would like to introduce the work and briefly describe the process (section 1). Following on from that I will discuss the aesthetic outcomes in relation to programming in Swift (section 2).

Whether the completed work is ultimately art, a game, gamefied music or something else will be discussed in section 3.

TechnoSpaces

The work is an IOS application that allows the user to navigate through various screens / soundscapes. Each screen has a different visual component and these screens turn over quite quickly. The sound is comprised (in part) of a background techno track that can be manipulated through interaction with the touchscreen of the iPad or iPhone. The four corners of the screen allow a different effect or process to be activated with different ratios of mix according to finger position. Touching the middle of the screen will bring all 4 processes into play at 1/4 power (amplitude).

Added to this when a particular game task is done (for example running over an enemy object or item) the kind and amount of effect or process is changed. An example of this is as follows. If (in the first screen) the player's avatar runs over an "alien" then the entire sound file is run through a distortion, which in turn is subject to the same morphing via 4 point crossfading described above. To be precise, the crossfading continues to have an effect on the sound (filters are applied or reverb is applied) but now the entire sound is shaped via the distortion. When another alien is touched / removed the distortion ramps down. Add to this a sound effect array is triggered at each such event (created in SuperCollider). This sound effect is triggered by events such as a collision and a random sound is picked out of the array. This interplay of elements and sound triggers creates a dynamic environment.

Below I will introduce some categories that relate to the construction and make-up of the work / game. A brief discussion of (or gloss on) each category will reveal aspects of the work and the making process associated with it.

Work title: "TechnoSpaces"

Touch Screens: The general idea was to create a work that allows some kind of utilisation of the iPad or iPhone screens to manipulate music files and synthesised waveforms. The screens themselves are quite a rich resource and provide an engaging way to manipulate the sound. Vector or Crossfading synthesis is a type of modulation that changes the emphasis of a sound (e.g partials) or series of effects (mix amounts) depending upon which screen section one is located in. The middle of the screen will provide a mix of 4 different components, and any given corner one component. In between one gets various different amounts.

The audio: work out a general approach to the music and sound of the work. This could really take any form, but as I was working with Swift and Apple's core audio framework there were some constraints. I have only limited experience with Swift and therefore the first steps were a kind of experiment.

Step 1: I utilised 2 techno tracks made earlier as the raw material for the first screens. I also made use of some synthesis using Swift and Core Audio. Added to this we have interactive tasks and game actions which have their own sound effects, these were produced in SuperCollider. The SuperCollider sound effects were imported into Swift as .Wav files. From there one can use Audio Units as "nodes" through which the audio passes. Effects can be applied in this way (filters etc.), and they can be applied equally to a synthesised tone or a Wav file. Chains of these nodes can be built up and manipulated. This is done by passing an audio "node" AVAudioPlayerNode() through various AVAudioUnits. Such chains can also be built on top of audio buffers (allowing synthesis and digital signal processing).

Step 2: I modified some Swift code (Allardice 2017) to create a series of synthesised tones. The code produced in TechnoSpaces allows a chord to be built up that changes with the user's finger position (or the position of the "player").

SpriteKit / ScreenKit: SpriteKit and SceneKit are the Swift IOS frameworks for game production. For the current (first) piece SpriteKit was utilised. It is not difficult to find tutorials for using the framework, and they can be turned towards more artistic ends. There are some very useful code forms in game design that can be appropriated, and SpriteKit offers some good ways to exploit and mine these. The work TechnoSpaces involves modification and customization of code from tutorials by Todd Perkins (Perkins 2017).

Imagery: In relation to producing the imagery various approaches were utilised. To create the "sprites" png files with a transparent alpha channel were constructed in Processing. Processing is ideally situated for this kind of work. It allows the artist freedom to quickly work things through and produce the elements that are required.

In the present case I was thinking that part of the game process would include small animated "enemy" sprites. These animations are made in Swift by animating in code the png files (constructed in Processing) with a timescale between frames. One uses 4 or 5 of png files as the basis of a small animation, and this animation is then put into play in the interactive game space.

Another way of adding interactive imagery and visuals is to use Shaders. Shaders are a very interesting and exciting way of making imagery (and manipulating imagery). Shaders (written in GLSL) are a type of program that makes use of the OpenGL framework. These shaders can easily be embedded in the Swift IOS system. The advantage of using these is that the visual then runs on the GPU of the device. This makes creating interesting and sophisticated visuals less CPU intensive, also allowing the programmer to keep the frame-rate of the application high. Shaders can be passed into an SKScene in Swift with the SKshader class which takes one parameter (the name of the shader itself: SKShader (fileNamed: "shader").

Aesthetics and Swift

The aesthetic outcomes of the "TechnoSpaces" application are multiple. The app allows one to navigate through a

series of screens in which music files are manipulated and visual tasks accomplished. The difficulty factor is not extreme: it is conceived as an enjoyable way to interact with sound and imagery. Each screen involves a background openGL structure that has some "movement". On this moving screen are embedded sprites and the "player". The touchscreen controls the "player", its avatar following the user's finger. The music and sound changes and is subject to the same gestures controlling the player. Other interactive sounds also appear and disappear within the sonic landscape.

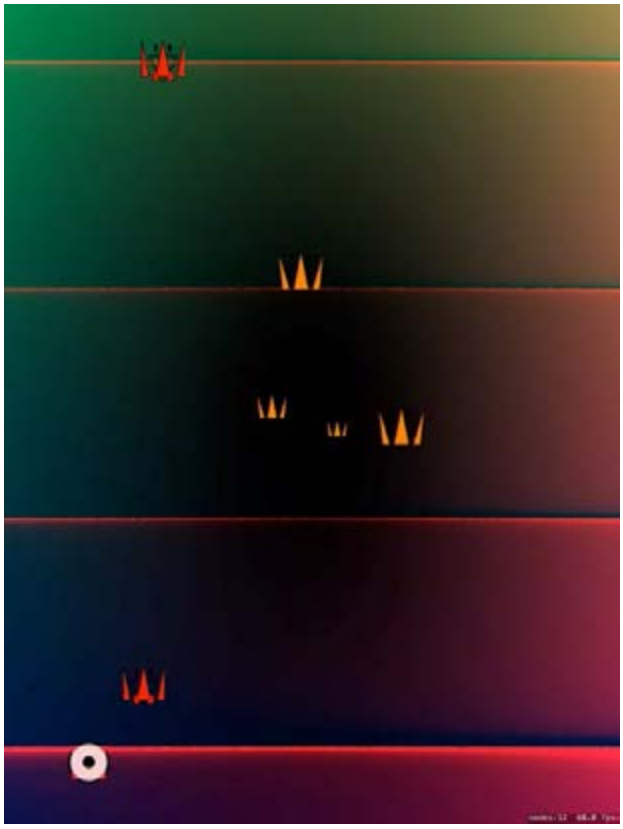

Figure 1. Screen from TechnoSpaces

The different classes governing each screen are written in Swift. The classes have some global components that run above the changing screens - for example the background techno soundtrack remains through the first series of screens. The manner in which it is manipulated / modulated changes with each screen.

Discussion

The working process described here is still in a nascent form. It is a step towards more complex interactions and sound manipulation. That said, even as it structured now it could be utilised as a performance tool that has some quite expressive capabilities. The touchscreen naturally lends itself to quick and fluid motions and the tracking is excellent. Using the work as a performance tool requires that everything be created with an eye (or ear) towards detailed musical and tonal quality. I have found that the parts are in place to allow such a focus on detail. Some extra yards are required in relation to the programming to ensure such results.

An aspect that could be emphasised is the rhythmic component of the interactions with the music. This would involve a task which can only be completed "on the beat" as it were. Thus the gesture would have to synchronise with the rhythms of the audio. This can be implemented quite easily by inserting a "tap" onto the output of Core Audio class. Such a tap could then be utilised as a test for collision or other captured gestures.

In relation to the status of the work and which genre it fits into, a couple of points can be made. At the moment the overall structure of the work make it very "game-like", and it is approached in this spirit often. However the author feels that it could easily become a performance tool for Electronic music, and it fits nicely into this category. As it stands it can be used in such a manner - adding bluetooth connectivity with a good pair of speakers fill out such a system.

Conclusion

Working in the field of mobile applications is a rewarding and exciting direction for artists and musicians to go in. However it is not always easy to know where to start. The present research offers a completed work for discussion and analysis. The framework is built from various different technologies that can be understood and used by all. It is often difficult to know how to combine the different technologies into a good and meaningful practice that will reward use. The present research presents an option, or series of options, that can solve some of these dilemmas.

The piece is currently in beta testing on Apple's "TestFlight". Interested parties can contact the author to be added to the tester's program.

The source code will be available for study / reference at the conference, the author will construct a gist for the purpose.

Acknowledgements

The author wishes to thank the Swift community for providing some of the answers to programming questions and CCS in Sydney for taking part in the Beta testing.

Thanks also go to the Interactive Media students at UTS for their great ideas and slick programming solutions.

References

Allardice, S. (2017). *Code Clinic: Swift.* Retrieved from https://www.lynda.com/Swift-tutorials/Code-ClinicSwift/362874-2.html?

Antonelli, P. (2012). *Video games: 14 in the collection for starters*. Retrieved from https://www.moma.org/explore/inside_out/2012/11/29/video-games-14-in-the-collection-for-starters/

Collins, K. (2017). *From Pac-Man to Pop Music: Interactive Audio in Games and New Media*, London: Routledge.

Perkins, T. (2017). *IOS game development with Swift 3 and SpriteKit*. Retrieved from https://www.lynda.com/Swift-tutorials/iOS-Game-Development-Swift-3-SpriteKit/512723-2.html

Zimmerman, E. (2014). *Games stay away from art, please.* Retrieved from https://www.polygon.com/2014/9/10/6101639/games-art

aSeeing with Machines:

Decipherability and Obfuscation in Adversarial Images

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Abstract

Adversarial images, inputs designed to produce errors in machine learning systems, are a common way for researchers to test the ability of algorithms to perform tasks such as image classification. "Fooling images" are a common kind of adversarial image, causing miscategorisation errors which can then be used to diagnose problems within an image classification algorithm. Situations where human and computer categorise an image differently, which arise from adversarial images, reveal discrepancies between human image interpretation and that of computers. In this paper, aspects of state of the art machine learning research and relevant artistic projects touching on adversarial image approaches will be contextualised in reference to current theories. Harun Farocki's concept of the operative image [1] will be used as a model for understanding the coded and procedural nature of automated image interpretation. Through comparison of current adversarial image methodologies, this paper will consider what this kind of image production reveals about the differences between human and computer visual interpretation.

Keywords

Adversarial images, machine learning, deep neural networks, artificial intelligence, invisibility, perception, operative image, algorithms, digital cryptography, decipherability

Introduction

Image identification tasks are becoming increasingly automated using machine learning to handle large visual data-sets. Adversarial approaches are developed in parallel to image classification algorithms in order to test algorithms' effectiveness by identifying errors, for example by causing an image to be misclassified. Many adversarial image attacks involve using discrepancies between the limits of human and computer image interpretation to make images human-readable but computer-unreadable. This means that an image may be adversarial in nature while having little to no outward indication that it is so. Adversarial content is thereby obscured from human vision while the image's human-determined meaning is obscured from the computer. Close examination of adversarial images and the errors they trigger help discern the limitations of machine learning systems to decipher digital images. In the following paper, diverse examples of adversarial image approaches will be explored in relation to the concept of the operative image and the relative decipherability and obscurity of digital images.

Adversarial Approaches

While computers can be more efficient than humans at processing large amounts of visual data, it doesn't take much to render a human-interpretable image unreadable to a computer. Because machine learning systems are often black box, it is challenging to develop methodologies to test them and to understand the cause of errors which arise. Many adversarial images are intended to be human-readable at the same time as tricking an algorithm, using human image interpretation as a baseline to check when computer image interpretation diverges from that standard. For this reason, adversarial image attacks often involve image interpretation tasks which are easily performed by most humans but which pose immense technical challenges for current computers [2]. Merely flipping an image upside down, for instance, can render an image incomprehensible to a computer and cause the image to be classified as something other than what it appears to be to humans. On the other end of the spectrum, computers can be tricked into classifying images consisting entirely of visual noise as specific objects, with a high degree of certainty [3].

Transformation, distortion, the addition of visual noise and the use of context cues are a few of the most commonly used techniques to achieve errors in algorithmic image classification. These approaches rely on problematising tasks in which humans excel, which correspond to computer inability. The production of images which are read differently in parallel by humans and computers entails understanding and implementing differences between the two visual processing systems. Internal knowledge about the way that humans see and process images is synthesised with knowledge about the boundaries of computer vision. Much like vision charts used to measure the resolution of biological vision, which test the limit of what size letters a person can read at a distance, adversarial images function as a test to determine the limits of image classification algorithms. If a computer classifies an image of a cat as an ostrich (see Figure 1), for example, a limitation in the image classification algorithm used is thereby established.

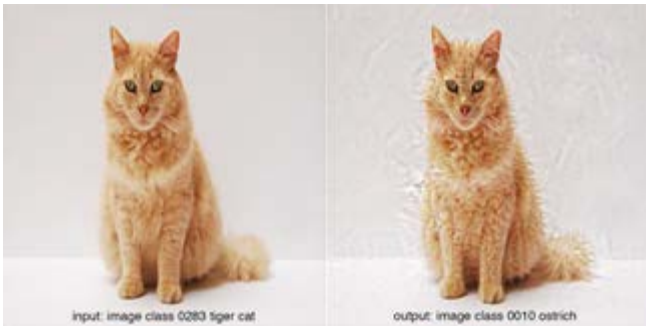

Figure 1: Image processed using the Ostrichinator web demo. The image was initially classified as class 0283: tiger cat, but after processing, the image is classified as class 0010: ostrich.

Adversarial Image Research

The past year was an eventful one in machine learning research, with several papers causing shockwaves in the field with adversarial examples which showed that although algorithms for analysing images are human-competitive in many ways, they are not without flaws. Two ground-breaking examples of adversarial image attacks include an approach whereby only one pixel in an image needs to be modified to trigger an error [4] and a 3d-printed turtle, which computers confuse for a rifle [5].

A research project known as the "one pixel attack" [4] demonstrated that significantly changing a single pixel was enough to cause it an image to be miscategorised by otherwise highly successful algorithms. In this project, researchers sought to change images in a human-imperceptible fashion while rendering them unreadable to algorithms. By limiting the transformation of the starting image to a single point, it is possible to maintain an image's semblance for human viewers. Many common adversarial attack approaches apply a slight perturbation to all pixels in an image, but by contrast, this methodology limits the number of pixels altered but allows the perturbation to be unlimited in scale. "Natural images", the data-set of images to be sorted, were evolved using an evolutionary algorithm which tested out different variations on the image. This process was used to determine the placement of the attacking pixel which would be changed and the degree to which it was altered from the original. For each starting image, a set of attacking images was evolved, corresponding to each of the possible target classes used in the experiment. Different versions of an image of a dog, for instance, were thereby made to register as a cat, an automobile, a frog, and so on.

Another innovative project entailed 3d printing a fairly realistic-looking turtle, which, when placed in front of a webcam and analysed by a deep neural network is registered as a rifle [5]. The effect is successful from any angle the turtle is positioned in, whether it is tilted, flipped upside down or turned in any direction. The method used is similar to that of the one-pixel attack, taken a few steps further. In this approach, an adversarial image-texture is developed and validated, then mapped onto a 3d model and made into a physical object. The attacking image is thereby made resistant to variations such as position, lighting and background, making it suitable for real-world application. This project also involved a large amount of practical testing, examining how the objects were "perceived" in various situations. It also moves beyond the still image, toward dealing with visual content "in the wild", by bringing adversarial image approaches into the physical world of objects.

Applications have also been made publicly available for use by non-experts, including the Ostrichinator web demo [6]. The Ostrichinator enables users to automatically transform an ordinary image in such a way that it is classified as an ostrich, using the smallest possible change of pixels. One can also select to change the image so that it registers as another class of images by selecting from a drop-down menu. In the example produced for the purpose of this paper, an image of a cat was transformed so that it would be misclassified as an ostrich. (see Figure 1.)

Artistic Adversarial Image Approaches

Artists have taken on related investigations, considering how computers interpret images and seeking to implement those parameters as a visual language.

Adam Harvey, in his project *CVdazzle* [7], has produced a look-book of suggested styling tips for evading face detection. The makeup and hairstyles presented in the project break the continuity of models' faces with colourful, angular lines, patterns and tufts of hair in unexpected places. By disrupting the symbols which constitute a face for computer vision, these styles render the face undetectable. Another project of Harvey's works toward undermining biometric identification by merging passport photos of multiple people. The images created through this process can thereby be used by one person so they can pass as someone else, without arousing the suspicion of a border control officer.

Sascha Pohflepp's Spacewalk [8] is a generative adversarial network (GAN) [9] which functions like a game played between two neural networks. The one neural network creates images with the goal of tricking the other neural network into classifying the fabricated image as a "real" photograph. The data used to train the networks is a set of images of predatory animals, leading to images of mangled, leopard-printed shapes, suggesting a clash between predator and prey. What is interesting about this approach is that it involves the generative neural network making inferences about what might appear convincing to the judging neural network.

Richard Overill's *Image Steganography* consists of a fairly ordinary-looking snapshot of a girl leaning against a railing [10]. What is significant about this image is that it contains another image embedded within it. Using the technique of digital steganography, Overill concealed a secret message within the least important pixels which define the visible image by offsetting their values nominally. Using a special code one can unlock the hidden message, which was the source code of the same image, from the picture.

Relation to Own Artistic Practice

The author has conducted explorations in adversarial image approaches within her own research-based artistic practice. One such exploration looked at abstraction as a weak spot in image classification algorithms. Due to the absence of image classifiers accounting for abstraction, non-representative images are a great challenge for algorithms to classify. As a critique of the over-determination in machine learning research, the author compiled a data-set of abstract paintings from the Metropolitan Museum of Art's online database and subjected the images to algorithmic analysis using the Wolfram image identifier [11], a successful online image classification program. (see Figure 2) Surprisingly, the abstract images returned a similar success rate compared to expressly-designed adversarial images. 98% of the images were categorised incorrectly as being objects ranging from axes to eggbeaters, even a sea snake and an igneous rock. 2% of the images were correctly categorised as paintings. The abstract paintings analysed in this experiment bore little or no visual resemblance to the classes assigned to them by the computer, but each misclassification added layers of poetic meaning to the respective image. The results of the experiment point toward the conclusion that adversarial images owe their success not to being specially designed to trick algorithms, but rather to being abstractions for which there is no image class in a system which insists all images belong in a category. While abstraction for humans appears to be a continuum along which representations vary, image analysis algorithms lack such notions of conceptual connection across visually diverse images.

Operative Images

Harun Farocki's theory of the operative image is useful in understanding the processes at work in adversarial images. He describes a turn away from representation in favour of implementing visual procedures which may or may not be intelligible to human viewers.

"These are images that do not represent an object, but rather are part of an operation." [1]

In an operative image, what is displayed on the screen is merely a by-product of the operation the image helped to perform. Thus, there is less need to make digital images interpretable to "meat-eyes" [12] and we find ourselves immersed in an image culture where humans are at times a secondary audience. A drone, for example, searches for a flight path using digital video, verifying landmarks as it flies, and adjusting its course accordingly. In the footage Farocki used for his piece "Eye/Machine" and which he uses as an example of an operative image, there's frankly not much for human viewers to see. The video is primarily used as input to guide the flight of a drone. Here, the visual is subjugated to the procedure of navigation and the work fluctuates between visualisation and non-visual processes. While operative images are not necessarily intended to communicate with the human senses, they do so nonetheless. There is a digital residue for us to look at,

Figure 2: Abstract painting as classified by the Wolfram image identifier.

though we may not understand what it represents. Harun Farocki's work on operative images has been described as an exploration of how to see like a machine [12] and it offers a useful perspective on the human interpretation of images intended for computers.

Decipherability & Obfuscation

The parallel interpretation which occurs in adversarial images entails a two-sided invisibility. There are two levels on which the image functions upon: the human-decipherable image, which is obscured from the computer, and the computer-decipherable image, which is obscured from the human viewer. To render an image indecipherable, in terms of adversarial images, is to ensure it can be read in more than one way. Thus, an image may be unreadable while its intended meaning is hidden in plain sight. Often machine learning systems are opaque, even to their creators, so the errors which arise from adversarial images offer useful insights into their functioning. Adversarial images can help to visualise incongruencies between biological vision and automated image processing by pointing out errors in interpretation. Images which are categorised by algorithms as a different image class than their human-designated category allow us to examine what signifiers are involved in the process of miscategorisation. The kinds of methodologies used in adversarial image attacks are predicated on assumptions as to how human perception and machine learning image analysis relate to one another. For example, in order to create an image which will pass for a representation of a face for either a computer or a human viewer, it is necessary to know what signifiers indicate faciality to the respective receiver and what defines the parameters of the given perceptual system. Situations where image-class signifiers are not aligned with one-another demonstrate the gulf of difference between human visual processing and that of computers.

Adversarial approaches demand a certain level of objectivity in the image interpretation process, for an image

to be deciphered as an intended, “correct” interpretation, upon which a human audience can easily form a consensus. “No, that's not a rifle, it's clearly a turtle.” This requires that images be human-decipherable while being deciphered by computers as a different, pre-selected "target class". In this kind of interaction with images, human and computer visual processing tasks occur on different planes, based on fundamentally different processes and criteria. The overlap between human and computer interpretation of symbolic classes is thereby explored using human-oriented signifiers and parallel, but different, computer-oriented symbolic classes.

Conclusion

Digital images are palimpsests of information, containing far more than what is intelligible to the human eye. The photographic paradigm prevails, yet there is more at work below the surface of the image, their basis in algorithms concealed by a veneer of realism. The turn toward indecipherability and obscurity seen in adversarial images marks a shift in the culture of the screen [13], moving away from traditional pictorial representation toward that of actionable images [14]. Similarly, the progression which can be seen through the examples mentioned in this paper show how the operation of solving a visual task, causing an error for instance, takes priority over an adversarial image's visual content. It is necessary for the image to be transformed while remaining human-readable, but the human-readable representation is merely a cover for the message it sends to the computer or the reverse. In many cases, digital image processes are obscured from the view and understanding of humans, yet the errors visible in adversarial approaches reveal the disjunction between parts of images intended for human eyes and those for computer processing. The black box nature of image processing algorithms is rendered visible by identifying points where neural networks come out of alignment with human vision. The diverse adversarial practices examined here trace the boundaries between visibility, invisibility, human and computer, revealing hidden nuances of each. The image performs a function, which ends up deciphering human image interpretation at the same time as that of computers.

References

1. Farocki, H. (2004), 'Phantom Images', 12-22 in Saara Liinamaa, Janine Marchessault and Christian Shaw (eds) PUBLIC 29: New Localities.

2. von Ahn, L., Maurer, B., McMillen, C., Abraham, D., & Blum, M. (2008). reCAPTCHA: Human-Based Character Recognition via Web Security Measures. Science, 321(5895), 1465–1468.

3. Nguyen, A., Yosinski, J., & Clune, J. (2015). Deep Neural Networks are Easily Fooled: High Confidence Predictions for Unrecognizable Images. In Computer Vision and Pattern Recognition (CVPR). IEEE.

4. Su, J., Vargas, D. V., & Sakurai, K. (2017). *One pixel attack for fooling deep neural networks*. CoRR, abs/1710.08864. http://arxiv.org/abs/1710.08864

5. Athalye, A., Engstrom, L., Ilyas, A., & Kwok, K. (2017). *Synthesizing Robust Adversarial Examples*. CoRR, abs/1707.07397. http://arxiv.org/abs/1707.07397

6. Tsai, C.-Y., & Cox, D. (2015). *Are Deep Learning Algorithms Easily Hackable?* http://coxlab.github.io/ostrichinator

7. Harvey, A. (2010). CVdazzle [Look book].

8. Pohflepp, S. (2017). Spacewalk [Custom generative adversarial neural network, transfer print on mylar, LED floodlight].

9. Goodfellow, I., Pouget-Abadie, J., Mirza, M., Xu, B., Ward-Farley, D., Ozair, S., … Bengio, Y. (2014). Generative Adversarial Nets. *ArXiv:1406.2661v1*, (stat.ML). https://arxiv.org/pdf/1406.2661.pdf

10. Overill, R. (2014). Image Steganography: Digital Images as Covert, Subliminal Channels. *The New Everyday*, (The Operative Image).

11. The Wolfram Language Image Identification Project. (2015). https://www.imageidentify.com

12. Paglen, T. (2014). Operational Images. E-Flux, 59. http://www.e-flux.com/journal/59/61130/operational-images/

13. Manovich, L. (2001). A Screen’s Genealogy. In The Language of New Media (pp. 95–103). Cambridge: MIT Press.

14. Hoelzl, I., & Marie, R. (2015). Softimage: Towards a New Theory of the Digital Image. Bristol/Chicago: Intellect Ltd

Author Biography

Rosemary Lee is an artist and researcher whose work investigates interrelations between technologies and processes of natural science. Their work brings together influences from media geology, hybrid ecology and posthumanism through theory-driven practice-led research. A selection of their notable exhibitions include *machines will watch us die* (Holden Gallery, GB, 2018), *A New We* (Kunsthall Trondheim, NO, 2017), *Hybrid Matters* (Nikolaj Kunsthal, DK, 2016), *TRANSART* (Dome of Visions, DK, 2015) and *Artifacts* (Palais des Beaux Arts, AT, 2015).

Rosemary Lee is currently a PhD fellow at the IT University of Copenhagen. She has also acted as artist-researcher in residence in international contexts including the Ayatana Arist Research Residency (CA, 2017), rural.scapes - Laboratory in Residence (BR, 2016) and the transmediale Vilém Flusser Archive Residency for Artistic Research (DE, 2014).

When electronic art was just art: The early days of new media in Brazil

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Abstract

This paper introduces an ongoing research into the study of early Brazilian electronic art at a time when the very distinction between this and other artistic forms was almost inexistent. By reviewing the demands of contemporary practitioners and contrasting it to the situation found by artists during the Brazilian dictatorship, we find that the reception of those early artworks was very much positive: not only did these find space within traditional artistic institutions but were also displayed alongside other emergent genres at the time, such as mail or video art. We conclude this paper pointing to the necessity of a historiographical revision regarding new media art in peripheral countries that did not possess the well-developed infrastructure seen in more developed economies. It is this precarity that, we believe, marked those early years and its close relationship with the larger art world.

Keywords

Media art histories; Brazilian art; digital art; new media art; Latin American art; Historiography; Social History of Art; art and technology; postwar art.

Introduction

Back in 2004 in São Paulo, a city that arguably hosts the most affluent and central artistic scene in Brazil, a meeting of local new media art critics, academics, supporters and artists discussed the future of that practice in the country. Its diagnosis, according to its participants, was bleak.

This meeting, which was the result of another mobilization via the internet, argued for a change in the government order that regulated the market for private sponsorship of the arts in the country. In this system, which companies offer money directly to cultural projects in return of tax breaks, their practice, labelled as "technological art", was not explicitly detailed in the new government decree. Embodied in a petition signed by more than 600 individuals from all corners of the artistic field, their claim was focused on the "the immediate updating of the terms of *Portaria 01* from 02/19/2004, so that the professionals involved in the activities brought by the electronic era are not summarily and unjustly deprived of the benefits of a fundamental legislation" (Canetti, 2004 Author´s translation).

If we ignore the history of Brazilian artistic practices concerned with the uses of computational or other emerging technologies, one could be forgiven to believe that theirs was a relatively new and unknown genre. When reporting this mobilization, local newspapers, for example, only reinforced this view of a new and esoteric art (Abreu, 2004; Bloch, 2004). Moreover, given the assertiveness of the demands expressed by this group, it would be fair to assume that without this funding mechanism there would not be Digital, Technological, Electronic Art (or whatever label you may choose) in Brazil.

Yet, if we return to the roots of these practices in Brazilian culture, one may find a completely different scenario. Whereas in 2004 people were attempting to secure an exclusive space in the law in order to sustain their art, in the seventies and early eighties the very distinction between an 'electronic' art and a 'traditional' art would be alien to most in the field. This paper, the first steps into an ongoing research concerned with the development of digital or electronic art in Brazil, traces these early days when digital or electronic art was just and simply art.

Just (concrete) art

To comprehend the status of early Brazilian technological art (henceforth BTA), one needs to have two things considered: First, the position of its supporters and pioneers in the Brazilian artistic field at the time and, second, the political and economic contexts of Brazil´s turbulent and cruel dictatorship, which went from 1964 until 1985.

In relation to our first point, regarding positioning, here we are referring to the sociological literature interested in the disputes, production and morphology of groups of cultural producers and consumers mostly developed by the French sociologist Pierre Bourdieu (1986, 1993). When we use the idea of a position in the field, then, we are thinking of the space occupied by artists in relation to their peers. In other words, how does one individual compare to its peers as made explicit by the indexes of one´s successful (or problematic) career: the positive or negative reviews in the press, the institutional links, the awards, the number of exhibitions in respected galleries or museums, participation in Biennales etc.

It is this position, privileged in contrast not only to the situation described in 2004 but also in relation to the position of other pioneers in different national contexts in the sixties and seventies, that makes the Brazilian case study such an aberration in the histories of new media, electronic or digital art. Rather than being realized by engineers head-

ing to art, as in the cases of Frieder Nake, Michael Noll, Georg Nees and others, BTA begins with one of the most recognizable and respected leaders of the Brazilian concrete art movement: Waldemar Cordeiro.

Already an established and central figure in Brazilian art in the late sixties, a period which marks his first computational experiments (Kac, 1997), Cordeiro´s support and argument in favour of computers and IT is repeated by the actions and words of his contemporaries and the generation that follows. In fact, this list is vast and cannot be dealt within a short paper: We can see this support in the words of Augusto and Haroldo de Campos, respected poets and scholars also belonging to the concrete tradition (Campos, 1997); in the exhibitions organized by the director of the São Paulo Museum of Contemporary Art (MAC), Walter Zanini (1997), which still figures as one of the central institutions of Brazilian art; in the spaces dedicated to the discussion of computer art in newspapers and the media of the time (Buongermino et al., 1972), as well as of cybernetics in relation to art (Barroso, 1958); in the *poesia processo* experiments of Wlademir Dias-Pino (Dias-Pino & Kac, 2015) etc.

Between the late sixties and the seventies, then, to comprehend the status given to BTA is to look for its concrete art links. A phenomenon also seen in other nations, especially in Germany (Klütsch, 2012), early BTA is, in essence, a by-product of a dominant discourse in Brazilian artistic circles at the time. Exemplified by the connection between Max Bense and the de Campos brothers, the links that tie these new artworks and their reception must not be thought outside the importance of concretism and the standing of its followers in Brazil. Whereas concrete art in Europe and the US was one of the many active styles of the postwar period, the Brazilian concrete tradition is, even today (and for better or worse), a standard for thinking about contemporary art and its development (Amaral, 2006; Asbury, 2006; Moura, 2011).

Technology in the periphery

Despite the importance of its supporters, BTA was not, in any sense, as technically developed as its counterparts in the northern hemisphere. The reason for this is straightforward: Brazil did not have a well-developed computing or electronics industry that, in many cases, supported the works of pioneers and dedicated institutions in the US or Europe (Nunez, 2016; Shanken, 2005). In Brazil there were no associations such as SIGGRAPH, CAS and E.A.T. or sponsors such as ACM, IBM, Westinghouse, BCS etc. Moreover, given the military government propensity in promoting local producers in order to control the whole manufacturing process of electronics and computers, later consecrated by decree and protectionist policies, Brazilian hardware was not *on par* with or commonplace as its northern hemisphere counterparts. While BTA mostly developed via connections between artists and academics, as in Cordeiro´s example, who alongside Giorgio Moscati, a physicist at the University of São Paulo, used the university infrastructure to develop his own works (Fabris, 1997), the industrial sector support seen in other developed nations was almost inexistent[1].

Yet, this same lack of resources and support, alongside the artistic pedigree of its supporters, seems to counterintuitively play a beneficial part in the artistic reception of early BTA, a reception far different from the one seem in other nations, where by the early seventies hostility, prejudice and disregard were the norm (Taylor, 2014). Whereas artists in the US and Europe would gravitate towards dedicated institutions such as the ones mentioned above, either because these offered material support or because the inherent difficulty in finding a niche in traditional art spaces, especially following the humanistic turn of the late sixties (Nunez, 2016; Taylor, 2014), early BTA, although poor and lacking specialized resources, saw its position in traditional art spaces as a normative development of art itself. It, in other words, did not need to retreat to its own space so it could thrive: its space was within the same institutions, museums, groups and galleries belonging to normal, non-electronic art.

We can see this unusual development when we look at some of the exhibitions and artworks of the period following the first adventures of Cordeiro. It is this next generation that, we believe, really stand out in the history of new media art: rather than focusing on technology *per se*, these exhibitions were dedicated to ANY new technology. As such, it is in 1985, the last year of the military government, that we find the paradigmatic exhibition that clearly reflects this unifying characteristic of early BTA. *Arte: novos meios/multimeios. Brasil '70/80*, realized at the *Museu de Arte Brasileira*, a private museum belonging to a private university in one of the richest São Paulo neighborhoods, was a huge undertaking reflecting both the propensity to think as new media anything that was not usual to artists and, at the same time, simpler and complex technologies. As its curator at the time wrote it, the exhibition was the "first attempt to reunite in the same space a broad collection of artistic manifestations that are expressed through non-traditional means – new media – and its intersections – multimedia" (Peccinini, 2010, p. 13 Author´s translation). Explicitly organized with the intention of revisiting 15 years of unconventional Brazilian art, it exhibited around 1500 artworks and it had 65 artists, showing in the same space and under the same label very different objects, namely: "computer art, super-8, audio-visual devices, offset prints, stamp art, heliography, photocopy art, mail art, videotext art, audio art, facsimile art, video art, intermedia installations" (Ibid.). At it we had more traditional computer artworks, such as the prints realized by Cordeiro and Moscati (Figure 1), placed alongside the photocopies and

[1] A notable exception is the avantgarde magazine *Código* and its editor, Erthos Albino de Souza. An engineer at Petrobras, Erthos produced generative poems whilst at his main occupation, in a similar fashion to German or American pioneers. Following a recent grant, *Código* has been recently scanned and uploaded in its entirety. It can be found at codigorevista.org.

mail art projects of Paulo Bruscky (Figure 2 and 3). New media, in this context, did not signify computers or electronic devices. The label new media or, as the curator puts it, *multimeios*, encompassed all unconventional and new technologies of its time, from holography to off-set prints, from super-8 films to teletext animations.

Conclusion

We have briefly seen that, differently than the dire situation described by artists and critics of 2004, the early efforts of Brazilian artists engaged with new technologies, computers included, was very much in tune and accepted by the local artistic field. Although not as technically complex as its northern hemisphere counterparts, these early artworks were normatively framed as valid expressions by the field in general. From the point of view of its legitimacy at the time we can conclude that, in contrast to our contemporaries, the symbolic stock of current practitioners, i.e. the acceptance of these practices as art, is far from guaranteed.

This conclusion, however, raises two distinct questions. The first, related to our case study, is concerned with the changes testified by that 2004 group. If, as we have demonstrated, the early position of BTA pioneers was relatively comfortable, what happened after the Brazilian dictatorship that resulted in the difficulties narrated by contemporaries? It seems that in the nineteen-year gap that separate both events, the 1985 *multimeios* exhibition and the 2004 petition, enormous social, technical and artistic chances resulted in a gradual but certain exclusion of BTA from the cannon of Brazilian art. It is a consequence of this exclusion, perhaps, that can be seen in the requests of autonomy and exclusivity seen in the 2004 petition.

The second question raised by these observations is related to the peculiar position of developing nations such as Brazil and the development of electronic art practices in these contexts. Unable to match its developed counterparts, artists in Brazil expressed their questioning of traditional artistic supports not with complex or expensive hardware, but rather with readily available technologies. Although artworks classically seen as 'electronic' or 'computer' art do exist, these were not, as one might expect by looking at the histories of such practices in developed nations, seen in exclusive and dedicated spaces such as ISEA itself. Is it the case, then, that the very material backwardness of nations such as Brazil resulted in very different histories of electronic art? Hopefully, with the development of the research sketched here, we will be able to answer those questions.

Figure 1. *"A mulher que não é B.B."* (Detail), 1969, Off-set print and IBM 360/44 computer

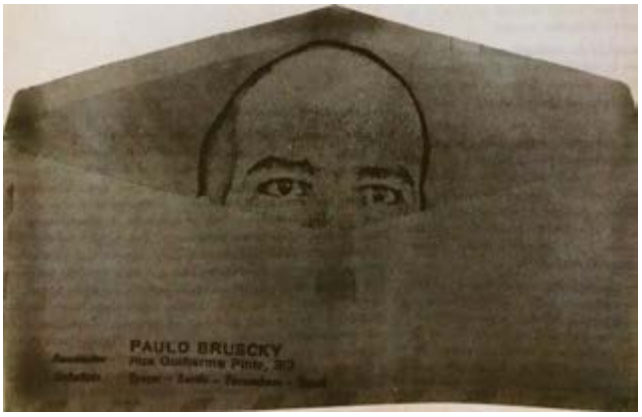

Figure 2. *"Auto-Retrato"*, 1975, mail art and envelope

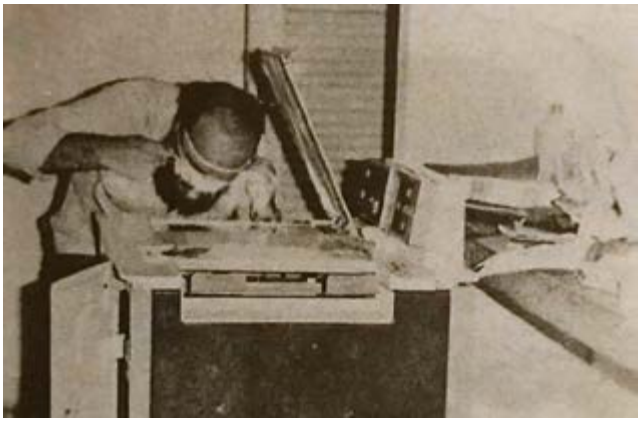

Figure 3. *"Xeroperformance"*, n.d., photocopy machine and performance

Acknowledgements

This research is being financed by the Postdoctoral Fellowship grant #2017/13635-5 awarded by São Paulo Research

Foundation (FAPESP) and is being conducted at the *Faculdade de Filosofia, Letras e Ciências Humanas* (FFLCH) at the University of São Paulo (USP).

References

Abreu, G. de. (2004, March 4). Por uma lei menos burocrática. *Jornal Do Brasil*. Retrieved from http://www.canalcontemporaneo.art.br/tecnopoliticas/archives/2004_04.html

Amaral, A. (2006). Duas linhas de contribuição: concretos em São Paulo/neoconcretos no Rio. In G. Ferreira (Ed.), *Crítica de arte no Brasil: temáticas contemporâneas* (pp. 83–88). Rio de Janeiro: Funarte.

Asbury, M. (2006). The Bienal de São Paulo: Between nationalism and internationalism. In S. Feeke & P. Curtis (Eds.), *Espaço aberto/espaço fechado: sites for sculpture in Modern Brazil* (pp. 73–83). Leeds: Henry Moore Institute.

Barroso, I. (1958, October 19). Cibernética. (G. A. Nunez C A, Trans.), *Suplemento Dominical do Jornal do Brasil*, p. 1.

Bloch, A. (2004, April 4). Arte é tudo. É? *O Globo*. Retrieved from http://www.canalcontemporaneo.art.br/tecnopoliticas/archives/2004_04.html

Bourdieu, P. (1986). *Distinction a social critique of the judgement of taste*. London: Routledge & Kegan Paul.

Bourdieu, P. (1993). *The Field of Cultural Production: Essays on Art and Literature*. (R. Johnson, Ed.). New York, NY: Columbia University Press.

Buongermino, R., Chiaverini, M., Kusuno, T., Vlavianos, N., Carvalho, F. de, Zanini, W., … Cordeiro, W. (1972, September 17). O Artista entre o computador e o conceitualismo. *Estado de São Paulo*, pp. 4–5.

Campos, H. de. (1997). Depoimento sobre arte e tecnologia: O espaço intersemiótico. In D. Domingues (Ed.), *A arte no século XXI: a humanização das tecnologias* (1a ed, pp. 207–215). São Paulo, SP: Editora Unesp.

Canetti, P. (2004, March 19). Mobilização pela arte tecnológica. Retrieved 20 October 2016, from http://www.canalcontemporaneo.art.br/tecnopoliticas/archives/cat_abaixoassinado_e_reunioes.html

Dias-Pino, W., & Kac, E. (2015). Interview with Wlademir Dias-Pino, revolutionary poet. *ARS (São Paulo)*, *13*(26), 6–56. https://doi.org/10.11606/issn.2178-0447.ars.2015.106064

Fabris, A. (1997). Waldemar Cordeiro: Computer Art Pioneer. *Leonardo*, *30*(1), 27–31. https://doi.org/10.2307/1576372

Kac, E. (1997). Introduction: Waldemar Cordeiro's 'Oeuvre' and Its Context: A Biographical Note. *Leonardo*, *30*(1), 23–25.

Klütsch, C. (2012). Information Aesthetics and the Stuttgart School. In H. Higgins & D. Kahn (Eds.), *Mainframe experimentalism: early computing and the foundations of the digital arts* (pp. 65–89). Berkeley: University of California Press.

Moura, F. R. de. (2011). *Obra em construção: a recepção do neocentrismo e a invenção da arte contemporânea no Brasil* (Doutorado em Sociologia). Faculdade de Filosofia, Letras e Ciências Humanas, Universidade de São Paulo, São Paulo. Retrieved from http://www.teses.usp.br/teses/disponiveis/8/8132/tde-20032012-122750/pt-br.php

Nunez, G. A. (2016). *Between Technophilia, Cold War and Rationality: A Social and Cultural History of Digital Art* (PhD). University of the Arts London, London.

Peccinini, D. (Ed.). (2010). *Arte, novos meios/multimeios : Brasil 70/80.* São Paulo, Brazil: Fundação Armando Alvares Penteado.

Shanken, E. A. (2005). Artists in Industry and the Academy: Collaborative Research, Interdisciplinary Scholarship and the Creation and Interpretation of Hybrid Forms. *Leonardo*, *38*(5), 415–418.

Taylor, G. D. (2014). *When the machine made art: the troubled history of computer art*. New York & London: Bloomsbury Academic.

Zanini, W. (1997). Primeiros tempos da Arte/Tecnologia no Brasil. In D. Domingues (Ed.), *A arte no século XXI: a humanização das tecnologias* (1a ed, pp. 234–246). São Paulo, SP: Editora Unesp.

Phantom Pain: From Absence Dearest Memories Are Born

Abstract

Phantom Pain is a creative practice research project addressing the extinction of indigenous languages as a consequence of the marginalization of ethnic groups. Specifically, this project focuses on the history of Sirionó people in Bolivia, and how their struggle to maintain its language, almost on the verge of extinction, can be related to physical trauma if society is understood organically as a body. Seeking to mirror the speed, inevitability and impact of language loss, document conservation and restoration techniques were reversed in order to accelerate the destruction of the artwork itself.

Keywords

Linguistic Diversity, Language Loss, Endangered Languages, Creative Practice Research, Physical Trauma, Indigenous Cultures, Restoration.

Introduction

Although there is notable discussion in how languages represent the world with greater or lesser degrees of accuracy and distinction, it is commonly accepted that they nevertheless constitute an undeniable form of knowledge for that specific world (Orman, 2013). Every language is essential by the sole fact of its own existence, and among multiple reasons that can be argued in favor of their importance, I chose here to remark Kristeva's understanding of language functions as a "carrier wave of anamnesis." Not hyperbolically, the loss of languages implies the disappearance of a cultural trove that encodes a unique epistemological point of view. The vitality, versatility and stability of each language promote the rights of their speakers to participate in the global community on and in their own terms (Hornberger, 1998).

According to the Atlas of the World's Languages in Danger of Disappearing, published in 2002 by the United Nations Educational, Scientific and Cultural Organization (UNESCO), half of the 6,000 or so languages spoken in the world will disappear by the end of this century. In the case of indigenous languages, it's only certain that their precarious situation is part of a much wider context, whereas politically dominant languages and cultures "embattle" them to the point of endangerment (Hale, 1992). Indigenous languages are deemed worthy of preservation not only because their specificity and importance from an academic/scientific perspective, but mainly because what is at stake for their speakers is beyond mere linguistics: social recognition, political autonomy and economical freedom. The link between sociopolitical power and language use is not new; Roman historian Tacitus highlighted it centuries ago when he wrote: "The language of the conqueror in the mouth of the conquered is ever the language of the slave." (May, 2017) In sum, languages loss processes are deeply shaped by cross-cultural encounters and post-colonial domination.

The Loss of a Limb

Classical sociological thought (Comte, Spencer, Durkheim) introduced the organismic analogy of society as a living being (the critique of this theory, mainly by Max Weber and his rejection of supra-individual concepts, and later by functionalism, is out of reach for the purpose of this paper). Early as Comte, society was characterized by an order found amongst families, classes and cities, or the internal organs of the social organism. These organs are contained by religious communities, labor division and, most importantly, by linguistic communalities. In the late 19th century, Spencer added to the former concept the principles of evolution, equilibrium, and dissolution (Dunn, 2016), establishing further parallelisms between society as a biological and psychological entity. For him, the parts that constitute both organisms and societies can live on after the death of the whole, and by extension, they also can keep on living regardless the disappearance of some of their constituent parts.

Following this analogy, a linguistic community is then a constituent part of a society, and its extinction would amount to the loss of a limb. As argued by Bohórquez, the imposition/acquisition of languages, in detriment of one's own language, which can be traced to a process of external or internal colonization, provokes a "profound disorganization of the socio-symbolic coordinates that ground the subject's sense of selfhood" (Bohórquez, 2009). The loss of a limb is an obvious trauma, and in the same manner the disappearance of any language inflicts a permanent scar on its society history and memory.

French military surgeon Ambrose Pare was the first to report phantom pain phenomena in the mid-sixteenth century, but until the 19th century the term "phantom" came to be widely accepted (Murray, 2010). Not anymore a medical mystery, modern research on phantom limb pain (PNP) supports its existence as a real and organic pain. This condition occurs after a peripheral nerve supply is disconnected from the central nervous system. The body part then, but not always, develops into a phantom pain. When this occurs, patients experience sadness, anger and an acute awareness of loss, leading to depression and isolation, but also, acceptance and hope. The same can be said for the speakers of an endangered language.

Sirionó People

The earliest record in Western historiography of the Sirionó people occurred in 1693 as recorded by the *Edifying and Curious Letters Written by Missionaries of the Society of Jesus*: "Shortly after, the saint discovered another nation. After traveling several days he found himself living with a group called Sirionó. At the moment when these barbarians perceived the Father, they readied their bows and were ready to shoot at him and his group of converts, but Father Cyprian moved toward them so kindly that arrows fell from their hands. He asked for some of them to remain in his group, and when he visit their settlements discovered another nation called the Guarayans" (Holmberg, 1950).

Various actors throughout history confined the Sirionós, nomadic hunters and gatherers, to limited geographical areas. A significant numbers of their people were sequestered in Jesuit missions in the seventeenth and eighteenth centuries. Then, in the nineteenth century, due to the rubber industry boom, entire families were separated and exploited in factories as slaves. In the early twentieth century it was the turn of the Franciscans and Evangelists, and in the thirties, finally, that of the Bolivian State. Sirionó traditions adapted under the risk of disappearing to new social, economic, political and spiritual demands.

In 1950, the American anthropologist Allan R. Holmberg published the results of his in-situ research: *Nomads of the Longbow: The Sirionó of Eastern Bolivia*. The perspective was such of his time: there was no empathy for the culture. He catalogued them as one of the most backward peoples of the world, unwilling to work, unable to take advantage of tools, superstitious, indifferent to myths, simplistic, lacking social stratification, and indifferent towards intellectual speculation.

At the time Holmberg visited the region, he failed to notice that the few Sirionó he had contact with were the remnants of a once three thousand people community, most of whom died from a flu epidemic in the early 20th century. Their culture reflected survival and scarcity. Still, Holmberg's book served as an academic reference for several years to address the cultures of other indigenous peoples. Nevertheless, the so-called 'Holmberg's mistake' (the supposition that Native Americans lived in an eternal, unhistorized state, without ability to act) remained in force and even fanned out to pop culture (Mann, 2005).

In the late 20th century, various Sirionó groups united to demand from the Bolivian government a complete vindication of their culture and territory. In 1997, they were given just over 52,000 hectares (520 km2) thanks to a grassroots movement that started with the Indigenous March for Territory and Dignity, which took 34 days to arrive to La Paz. In the same decade, the Assembly of Sirionó People, their highest body of political decision, and the Sirionó Indigenous Council, were established. Through them, the defense of their territory, the use of economic resources and other issues such as conflict resolution and education were pursued.

Today, Sirionó people live in Beni's province of northwestern Bolivia, in Ibiato and Pata de Águila. Around five hundred families are the only speakers of Sirionó in the world. Adults and the elderly speak Sirionó and although children learn and study it is not their daily use language. Funds have been allocated to translate books and educational materials into Sirionó, in order to promote its use and conservation. Still, their language, like many others from Alaska to Patagonia in the American continent, has a rather uncertain future: like a stream without force, it narrows as years pass.

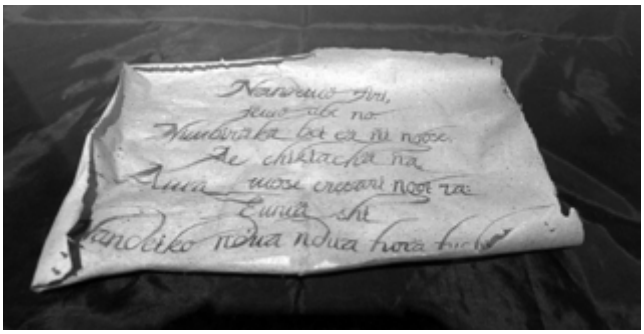

Fig 1. Rodrigo Azaola, Phantom Pain, 2016, IX International Art Biennale SIART, La Paz, Bolivia, 2016. ©Rodrigo Azaola.

Phantom Pain

Literature for loss limb patient is abundant. Following an amputation, an individual lives with a new reality, in which physical and psychosocial challenges need to be addressed. Body image and self-concept are the main psychosocial stressors (Desmond, 2008). Having in mind the analogy of language loss/limb loss I noticed that literature for patients focus on how to foster adjustment and adaptation, i.e., how to reach again psychosocial equilibrium, self-esteem, self-concept, and self-regard. Reinterpreting common concepts drawn from the literature reviewed, I wrote a poem for its translation into Sirionó.

We are somehow different,
but everyone is.
There is no victory without loss
Nor heroes without defeat.
Let time do its work:
From absence
dearest memories are born.

Given the status of Sirionó as an endangered language (Haen, 2015; Crevels, 2012; according to Gasparini & Dicarere Mendez, 2015, there are perhaps 40 people that can speak the language in a creative way), I decided to take upon that condition as a materiality prerequisite for the artwork. How could an object vanish at a predictable, if regrettable, inexorable rate?

Interdisciplinarity

I sought the assistance of Dr. Noé Gasparini, leading scholar in Sirionó language, from the University of Lyon Laboratoire Dynamique Du Langage, to translate the poem. Different considerations emerged that ultimately modified

the meaning of the poem. According to Dr. Gasparini, some concepts from the poem were simply not translatable, due to the lack in Sirionó language of existential sentences ("there is no..."). Moreover, the expression of general ideas without participants occurs very seldom. Also, Sirionó does not have concepts such as heroe, time or absence. Gasparini wrote to me: "I'm not sure how to translate *We are different* since the closest approach would be *We are unique*, implying diversity in uniqueness." All these considerations were taken into account to consolidate a new version, and with it, a Sirionó translation:

We are, and so are you,
a little bit different.
I'm surprised of not always
being able to be strong.
One can lose oneself.
In rain season, tears fall:
In nothingness,
our memories will be good.
Nandemö jiri,
jëmö abe no.
Nimbiräkä beɨ eä ñï ngose.
Ae chikiachä ña.
Ama mose eresari ngoɨ ra:
Emuä shɨ
Nandeiko ndua ndua turä tuchi je.

María del Pilar Tapia López is the leading researcher of the Documents and Graphic Works Workshop at the Mexican National School of Conservation, Restoration and Museography. In collaboration with her workshop, paper and ink were manufactured in order to accelerate the rate the destruction of the document in which the aforementioned poem was written. Attracted by the unusual task at hand, the workshop participants came up with a set of solutions. First, based in the recipe of the anonymous "A Booke of Secrets: Shewing diues waies to make and to prepare all sorts of Inke, and Colours" (London, 1596), fifteen milliliters of iron gall ink (its acidic range is equivalent to a lemon or black coffee) were produced. For the paper sheets, a special ground wood pulp was developed, due to its impurities that cause discoloration and weakening of the material (Bajpai, 2012). Finally, *Aspergillus* spores, known by its remarkable capacity to dissolve cellulose, were obtained from an 18th century infected book. *Aspergillus* is a group of fungi (asexual and non-motile) that is implicated in the bio-deterioration and degradation of documents (Pinzari, 2010). Such spores were sprinkled over the highly acidified paper and the ink.

In addition to these elements, other externalities were considered to quicken the deterioration of the document. Humidity levels were incremented through careful water sprinkling over the document, and as the artwork was located under a direct natural light source, heat was also present several hours per day. Fungus growth is a common feature in humid and hot environments. Spores start producing fungus cell walls, and its expansion consumes the material from the surface on which it grows (Prajapati, 2005). Paper becomes fluffy and moistened, colored with stains.

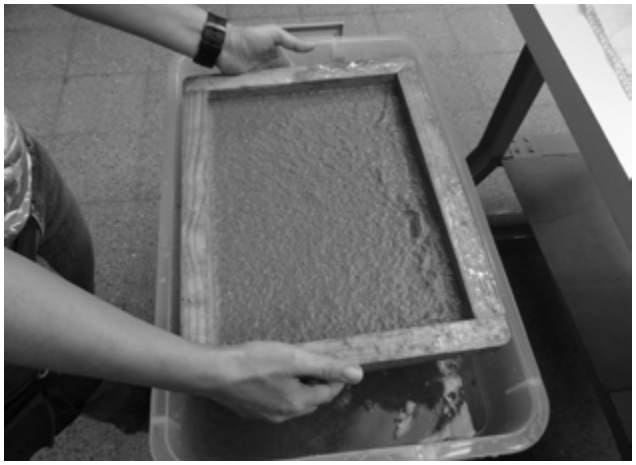

Fig 2. View of pulp and paper development at the Documents and Graphic Works Workshop at the Mexican National School of Conservation, Restoration and Museography. ©Rodrigo Azaola.

Fig 3. View of the 18th century infected book from which *Aspergillus* spores were obtained. ©Rodrigo Azaola.

Finally, over this period, I became acquainted with Milicia Eato Mano, Ibiato human rights specialist and lawyerand later President of the Sirionó Indigenous Council. Through her, I got a very accurate and actual status of the Sirionó language. For them, there is no doubt whatsoever about the need to preserve not only their language but also their traditions. She informed me that some teachers were studying the language, and from early childhood to high school, Ibiato children were taught Sirionó. Some pedagogical texts and the Bible have been translated, and there is more interest in the language since it was recognized as an official language of the Plurinational State of Bolivia. Indeed, since 1994, the reform of the Bolivian Constitution asserted the multiethnic and multicultural character of the country, as well as various indigenous collective rights, and in the 2007 Constitution all Bolivian indigenous languages were recognized as official languages (Crevels, 2012). In 2016, in Ibiato, the Sirionó Language and Culture

Institute was established. Nevertheless, Sirionó language remains severally endangered, as it lacks transgenerational transmission.

Phantom Pain was exhibited at the SIART Biennale (La Paz, Bolivia) in 2016. Due to the combined effect of the paper and ink acidity, and the action of *Aspergillus,* the calligraphy became unreadable after a few days, and within a fortnight the paper disintegrated. Its disappearance coincided with the time frame -every two weeks- in which it is estimated that one of the six thousand languages spoken on Earth disappears.

Conclusion

Socioeconomic interests, globalization and encroaching Western society (Crevel, 2015) are among the factors by which most indigenous communities are experiencing language shift (the use of a language being replaced by another) and language loss today (Lane & Makihara, 2017). Indigenous cultures in the Americas have been perpetually neglected and marginalized. The official discourse for the integration of indigenous peoples originates in a hegemonic position in which the poles are autonomy and perpetuation of poverty, or assimilation and consequent disappearance of the identity. Official processes to strengthen indigenous cultures, be they political, economic, cultural or linguistic, yield, at best, mixed results.

Phantom Pain aimed to integrate the undeniable fact of language loss, derived from a long legacy of marginalization, into an artwork that could physically render the notion of decay and disappearance. As argued, language is a constituent part of the society/body, and its loss equals both for an individual and for any society a profound change and acute disorganization within the sense of selfhood.

Creative writing, linguistics and scientific restoration and conservation techniques were integrated into an artwork that reflects on the political and cultural legacies affecting the survival of indigenous languages and cultures. Parallelisms between limb loss rehabilitation literature and the challenges that endangered languages societies face, were used to highlight aspects of individuals and societies trying to cope with a traumatic episode. Facing loss, the possibilities for growth and learning are emphasized as a palliative to memories of a time that cannot be recreated. However, the extinction of any language leaves a body –a society– mute and incomplete, unable to communicate unique experiences, resulting in the impoverishment of humanity as a whole.

Acknowledgements

Germán Fraustro Nadal, Documentary Collections Preservation Senior Lecturer, Mexican National School of Conservation, Restoration and Museography.

References

Bajpai, P. (2012) *Biotechnology for pulp and paper processing*. [Place of publication not identified]: Springer.

Bohórquez, P. (2009) "Psychic and Ethical Dimensions of Language Loss." *Journal of Intercultural Studies Carltin Vic*. 30.2: 157-172.

Crevels, Mily. (2012) “Language endangerment in South America: The clock is ticking”. In The Indigenous Languages of South America: A Comprehensive Guide, edited by Lyle Campbell and Verónica Grondona, 167-233. Berlin/New York: De Gruyter Mouton.

Desmond, Deirdre, et al. (2008) *Psychoprosthetics*. London: Springer London.

Dunn, Matthew Bjorn. (2016) *Reviving the organismic analogy in sociology: human society as an organism*. Thesis (Ph. D.)--University of California, Riverside.

Gasparini, Noé & Dicarere Mendez, Victor Hugo (2015) *Diccionario Sirionó*. Bolivia: Editorial Tiempos.

Haen, Theo , Iannis Goerlandt, and Roger D. Sell (2015) *Major Versus Minor? Languages and Literatures in a Globalized World*. Internet resource.

Hale, Ken, Michael Krauss, Lucille J. Watahomigie, Akira Y. Yamamoto, Colette Craig, LaVerne Masayesva Jeanne, and Nora C. England (1992) "Endangered Languages." *Language* 68.1: 1-42.

Holmberg, A.R. (1950) *Nomads of the Longbow: The Siriono of Eastern Bolivia.* Washington: Smithsonian Institution Press.

Hornberger, N. (1998) “Language policy, language education, language rights: Indigenous, immigrant, and international perspectives”. *Language in Society,* 27.4: 439-458.

Kristeva, Julia (1999) *Sens Et Non-Sens De La Révolte*. Paris: Librairie générale française.

Lane, P. and Makihara, M. (2017). Indigenous Peoples and Their Languages. In *The Oxford handbook of language and society,* edited by García, O., Flores, N., & Spotti, M. Oxford University Press, 2016.

Mann, Charles (2005) *1491: New Revelations of the Americas Before Columbus*. New York: Knopf.

May, Stephen (2016) “Language, Imperialism, and the Modern Nation-State System: Implications for Language Rights”. In *The Oxford handbook of language and society,* edited by García, O., Flores, N., & Spotti, M. Oxford University Press.

Murray, Craig (2010) *Amputation, Prosthesis Use, and Phantom Limb Pain an Interdisciplinary Perspective*. New York: Springer.

Orman, Jon. (2013) "Linguistic diversity and language loss: a view from integrational linguistics". *Language Sciences.* 40: 1-11.

Pinzari, Flavia, Mirca Zotti, Mico A. De, and Paolo Calvini (2010) "Biodegradation of Inorganic Components in Paper Documents: Formation of Calcium Oxalate Crystals As a Consequence of Aspergillus Terreus Thom Growth." *International Biodeterioration & Biodegradation*. 64.6: 499-505.

Prajapati, C. L. (2005) *Conservation of documents: Problems and solutions: policy perspectives*. New Delhi: Mittal Publications.

In a hole in Rural Saskatchewan, Canada without a Phone

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Abstract

A discussion of *The Hole Residency* provides a context for assessing the crucial role that technology can play in art projects that are framed in the boundaries of social practice or socially-engaged art, especially by the near-absence of technology in such projects. *The Hole Residency* is a project focused on duration, visceral experience, collaboration, and the opportunity to engage directly with nature. It also provides a framework for considering the relationship between art, science and technology within a hands-on context.

Keywords

Technology, nature, social practice, socially-engaged art, space, duration, collaboration, visceral

A discussion of *The Hole Residency* provides a context for assessing the crucial role that technology can play in art projects that are framed in the boundaries of social practice or socially-engaged art, especially by the near-absence of technology in such projects. *The Hole Residency* is a project focused on duration, visceral experience, collaboration, and the opportunity to engage directly with nature. It also provides a framework for considering the relationship between art, science and technology within a hands-on context.

The Hole Residency began as a durational investigation of a 6-foot-deep hole dug on my property on Treaty 6 Indigenous land in rural Saskatchewan, Canada. The hole is open to the sky, with a square tower of ground in the middle where a wild rose bush once stood. A neighbour with a backhoe dug a wide deep trench around the rosebush, and then added a ramp into the hole. Various layers of history are embedded in that land. The most recent historical event was the first settlers arriving on this specific plot of land in 1903. Just before this was the signing of Treaty 6 with the Indigenous population in the late 1800's altering the access to this land by the Indigenous peoples. The earliest information that I found about this land was the fact that a glacier passed across this specific area millennia ago.

As I told people about the project, various people wanted to visit, to read relevant material to me, and somehow to share the experience. I decided that the presence of other people in the hole would further

enrich the experience for me. I advertised the possibility of attending a one or two day residency in the hole on various residency sites. I had an overwhelming response to the call. In total 45 different people from coast to coast in Canada, and from England, Ireland, Israel, the Philippines, New York and the Netherlands attended the Hole Residency with me. I was in the hole for 65 days – some of the participants were there for one day, and others for two. Each person brought something original and special to their day(s) in the hole. Each day was a gift and a challenge for me. A crucial aspect of the process for me was the fact that each person allowed me to see the hole in a different way. Some people came with elaborate

arrangements for us, while others came with very few plans or expectations. Regardless of the starting point, each day unfolded with its own rhythms and memorable nuances.

The fact that this hole is in an isolated part of the country meant a shift in focus towards the natural environment surrounding us each day. Some people came with an extensive knowledge of geology, biology, ornithology. I expanded my knowledge of the birds flying overhead, and learned how to translate the details of flight patterns and markings to realize the extensive diversity of birdlife in the area. Maybe more relevant to this paper is the way that various people utilized the time to viscerally explore their natural environment. One person lay on the sand for hours and waited for anything crawling or flying to touch his exposed skin, a very embodied relationship to studying bugs. Another person physically moved with the line of the shadow of the sun, marking these edges with material available in the hole, as well as his own body.

The original plan was to live stream each day to PAVED Gallery in Saskatoon, the host organization. After much consultation with local companies, I realized that given the location and existing technology, the only way that I might possibly live stream was if a tower was installed near the hole. I developed an alternative system in which I used power packs to power a camera that would record onto one 64 GB chip for 6 hours each day. The power pack was deposited outside the hole with a camera adapter plugged into it. Wires hung over the edge limiting the movement of the camera. There was no camera operator, just a fixed camera, aimed generally into the space that we occupied. With no zooms or pans, the camera recorded what was in front of it. Participants had a choice in terms of the direction that the camera aimed, and some chose to focus on specific parts of the hole. Most ignored it. The chip was transported to Paved every evening to be inserted into the media player the next day at noon, totally unedited. People visiting the gallery made assumptions about the technology based on the coding embedded in the footage that often suggests live streaming, not considering the obvious limits of technology in most rural areas in Canada.

The total lack of access to the Internet or to electricity had other crucial consequences. No one was able to check one's cell phone. We were unable to get any weather reports including notice of an approaching tornado. No one could fact-check from science sites or use any on-line resources. We had no access to any entertainment except what was around us in nature. This unusual circumstance shaped all aspects of the time in the hole, including not knowing how much time had passed. (No one has watches anymore.) The day ended when the red light on the camera dimmed. This led to an emphasis on the visceral experiences provided by physically being present in the space. Participants looked to the sky and the shadows for a sense of time, reclaiming traditional modes of sensing the passage of time.

Many participants have written back to me talking about how much this experience has altered their core perceptions of the world around them. For each person, it was a unique opportunity to be present in silence and in intimacy with one other person, to pay attention to the walls of sand, to witness the details in the trailing roots that hung down from above, to listen to the various birds particularly the bank swallows that began nesting in the walls after the project began, and to have the luxury of 6 hours unbroken by digital interruptions. A crucial collaborator in this process was the weather. The spring and early summer of 2017 was exceptionally dry. However, during the 65 days, the weather ranged from brutally hot to bonechillingly cold, with pouring rain, hail, high winds that blew the sand everywhere, and even that nearby tornado.

It was crucial for me to enter into the hole each day with respect for the direction that each person was offering to me. The second person had asked to replicate a process that her mother and other elders did each year on Sweet Grass Indigenous Reserve in Treaty 6 in which they sat in a sacred natural location all day for a series of days. Completing these two days in silence in the rain and the wind of early May was a crucial turning point and message for me about the significance of just being present, and allowing each

person to respond directly to various aspects of the natural environment.

I recognize that talking about the nearabsence of technology at ISEA may seem counterintuitive. But by creating an environment that removed digital media except for an observing camera, an awareness of the role of pervasive technology became a crucial part of the experience. This project placed heightened emphasis on what we can learn by physically exploring a space – touching, tasting, listening, letting sensation flow over one's body. This ability to experience through all the channels of perception may be what we are in danger of losing with our focus on small screens and buttons.

Programming is Law

Can I be a feminist if I don't want to become a programmer?

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Abstract

Our individual existence, our bodies, our minds, are embedded within and artificially augmented by technology; we interact with similarly extended others. These interdependencies pose urgent ethical and cognitive questions. When looking into these complex relations and ethical urgencies, claiming that the individual, society and technology are separated from one another, may feel counterintuitive. Separation however, does not imply causal isolation, or complete independence but instead that one system does not directly control the other, however eligible they may be to influence one another.

Social and individual existence is tied to digital technologies. Informed by patriarchal power structures, their design and investigation both extends and creates new forms of oppression and alienation. As such, they become feminist agendas. Rather than refraining from participation in the technological sphere, radicalised exclusivity can be used as an operable device to increase inclusivity – a conclusion derived from the text "Xenofeminism: A Politics for Alienation" by the group Laboria Cuboniks. In the recognition of one's own alienation, one can find identity and liberation; and by actively increasing alienation there isn't simply reconciliation with the exclusionary status quo but the freedom to construct a different world. With this focus, this paper examines the importance of acknowledging the social and political implications of programming, and the limitations of this acknowledgment within theory and the discursive spaces it happens within.

Keywords

code, programming, feminism, Xenofeminism, exclusion, inclusion, alienation, technology, theory, art

Introduction

Lawrence Lessig's quote "code is law" should probably read, "programming is law", since code only knows a finite spectrum of possibilities (Lessing, 2006). In the case of binary code it's limited to two values, whereas within the process of programming it creates multiplicity, or at least seemingly infinite possibilities. Code builds the frame in which systems operate, their programming determining the actual value.

While every system has a code, its programming decides which particular value is chosen in order to actualise a particular situation. These terms are adopted from systems theory, its framework aiding in the exploration of the seemingly simple questions - how do certain processes function, and to what extent are they qualified to influence processes outside of their direct reign? How do we approach and not just simply acknowledge these technological processes and their social implications?

When talking about digital technology, the words 'code' and 'programming' have become increasingly common and are even treated colloquially. Given that these technologies significantly inform modern society, the question of who writes this law; who designs, implements, and enforces this set of rules which programming defines, becomes imperative. As Janning (2014) points out, it is programmers who seem to bring the social and technical world into contact with one another. They realise these relationships of otherwise separated systems by acting as translators, and by transforming elements from one world into elements qualified to exist in another. In order to communicate with the uncommunicative, they create masters and slaves, followers and leaders, parents and children. The languages they use are proof of this peculiar process; languages that aren't designed to optimise communication with computers, but instead to allow readability for the supervising, non-programming management (Jannig, 2014).

Technological, social and psychological systems are characterised by a circular relation of focused and effective stimulation, offering an exchange of one's complexity for the construction of the other (Esposito, 1997). This relationship allows for the transfer of our human abilities to machines, in turn using machines to employ what's human.

Technological inventions such as the Internet, Artificial Intelligence, and crypto currencies, exemplify the magnitude of how technology informs social processes. Their structures shape fundamentally social operations such as communication, access to information, exchange of value, and even access to physical space. These technologies also inspire change in an even more intimate sphere, influenc-

ing the interior life and thoughts of the individual. The extent of this is undeniable, so much that "[m]an and machine have now become isomorphic and indifferent to each other, neither is other for the other' (Baudrillard, 1992). Sigmund Freud (1930) called the human in his work "Civilization and Its Discontents" a prosthesis god, and according to Freud, human creations through science and technology fulfill most fairytale wishes. Based on this, one has to wonder whose fairy tales these are, and how we create our own rather than simply living in other's. Through the manipulation of the biological, animalistic physicality of humans, the operations of our brains and thoughts has migrated into prostheses, leading to humans becoming 'ex-centric' and 'ex-orbitant', as Jean Baudrillard (1989) has phrased it. However, this process doesn't strip us of our humanity but leads to humans emerging even more as psychological and organic systems, and by distinguishing their minds from their bodies, a space for liberation opens (Wagner, 2017).

Expanding this thought, the programming – and not the code – of technology influences the bodies we live in, shaping the way we interact with one another, our general environment, and the images we construct about our identities. The consequences of this are two-fold. Since long-established patriarchal structures inform technological design and its application, they extend systems of oppression. And because the programming of technology has such large-scale consequences, it can be manipulated to serve liberation. Both of these sides qualify technology to be part of the realm of feminism. Accordingly, branches of feminist theory have emphasised how technologies configure identities and how the intertwining of gender and technoscience is becoming increasingly complex (Wajcman, 2010).

The approach of Xenofeminism

One of the most intriguing recent publications that reflects upon the social implications of technology and the opportunities afforded by technological annexation is "Xenofeminism: A Politics for Alienation", by the group Laboria Cuboniks. Within the Manifesto it states, "[t]here is nothing, we claim, that cannot be studied scientifically and manipulated technologically " (Laboria Cuboniks, 2014). Although the focus in their text is the liberation of oppression, the focus of this analysis will be on their recognition of technological manipulation as a means of liberation.

Xenofeminism as a neologism is primarily well chosen. The prefix 'xeno' comes from the ancient Greek term xenos (ξένος) and means stranger, alien or other. The additional positive side can be found as early as within the works of Sophocles, describing the xenia rituals, which initiate a foreigner as a friendly guest (Belfiore, 1993-1994). In Xenofeminism, the prefix includes both of these elements; the alien and the affirmation of being alien. As Laboria Cuboniks (2014) formulates, "[i]t is through, and not despite, our alienated condition that we can free ourselves from the muck of immediacy. Freedom is not a given — and it's certainly not given by anything 'natural'." However, it might be questioned if the use of the term feminism, and its subsequent reference to 'female', is in support of binary genders and therefore not fully consistent with the advocacy of gender abolition by Xenofeminism. Yet I can sympathise with the need to use a heuristic crutch and the recognition of the importance of alienation in the use of the prefix most certainly outweighs this linguistic technicality. Similarly relying on this very crutch, my use of the term feminism is meant to describe a movement desiring to change unjust oppression based upon but not limited to gender.

Alienation is of course not only discussed in the title but even more so within the actual text of Laboria Cuboniks. As a concept for the formation and the dismantling of the self, alienation dates back to Marx, identifying it within desire, as desiring is inwardly directed to something outside the self – the alien (Marx, 1844). Within the Xenofeminist Manifesto alienation is being utilised as a mechanism to achieve inclusivity by radicalised exclusivity. As Elena Esposito describes in 2004, the Self doesn't discover identity in introspection, but legitimised idiosyncrasy, establishing the condition that everybody is distinguished from everyone else and identifying themselves with and by this very distinction. It's precisely by this that identity is formed – not merely in the observation or localisation of the self – but in the difference to others, in the recognition of one's own alienation to echo Xenofeminism. This relation to others can lead to an inclusionary process facilitated by radicalised alienation. Regarding the individual level, the formation of a sustainable identity is supported by recurrent external references and the experience of alienation. By accepting and enforcing being alien, the individual becomes more of an individual, not less. On the social level, the identification with alienating processes creates an inclusionary mechanism, a unifying affinity based on shared goals even when the underlying problems are disparate.

This inclusion is both threatened and facilitated by the programming of technology, as the Xenofeminists identify. On the one hand, modern technologies are not inherently beneficial due to their design and programming being informed by unequal and patriarchal structures, the infrastructures into which they emerge, and the imbalances of their access. Vice versa, programming can be adapted and technology appropriated in order to increase impartiality and to undermine these disciplinary power structures as a way to construct a more inclusionary world. In light of this, one possible strategy is to boycott technology, which is neither productive nor actually operational. Achievable only from a position of privilege, this refusal renders alienation as an entirely exclusionary mechanism, giving into its vigour rather than utilising it.

The Conundrum

As Laboria Cuboniks (2014) writes, Xenofeminism "seeks to strategically deploy existing technologies to re-engineer the world." When attempting to abolish systems of oppression, the importance of this statement cannot be stressed enough. In order to reconfigure an unjust society informed and shaped by unjust technologies, the very same technologies need to be manipulated. While it is tempting to withdraw into a local, less technologised reality in order to deal with global complexity and technological influences, it's insufficient in terms of being subversive. Xenofeminism emphasises that contemporary technologies need to be appropriated and mobilised to serve the liberation of disparities of power, to create "freedom-to rather than simply freedom-from" (Laboria Cuboniks, 2014).

The question that remains is how the Xenofeminist device can actually be inserted into technological systems. Their Manifesto needs to be viewed within the systems it operates within, and is part of a theoretical system even if it says that it is "unsatisfied with analysis alone" (Laboria Cuboniks, 2014). The Xenofeminist idea was present before the collective published the text, operating within a niche of the art system and is detectable in works by groups such as gynepunk, VNS Matrix, and G-Hack. When Xenofeminism is applied as an artistic strategy, it unfolds an aesthetic force that activates the invisible within the perceivable, allowing for the experience of the alienation of inscrutable others, and this creates its own paradox by synchronously dissolving it: the observation of the unobservable.

The linguistic form of their Manifesto is necessarily part of a different system than the programming of technological systems, and so are the systems it succeeded to inspire. Theoretical work per definition tries to explain how things work and only occasionally attempts to create something operable. But how can the recognition of technology and its programming, as both the cause of oppression and the catalyst of liberation, be transformed into something operable? The irony that this conundrum also affects this paper isn't lost on me, it also being a part of the theoretical realm. It's not that here, theory is being thought of as unable to generate change, but stated that it doesn't do so directly, but rather serves as a source of inspiration if and only if the structures of the systems it desires to inspire allow for it.

The actual entry points into technological systems are programmers, since they structure the very systems that are the cause of oppression and the catalyst for liberation. Although the cliché of the white male programmer in Silicon Valley is thrown around in lay discussions, programmers have experienced little sustained academic research interest. The reason for this might be the lack of sources, since company archives aren't accessible and code isn't readable or fully interpretable for most academics interested in their social implications. Academic reviews frequently argue that the programming of technological systems has historically not been an exclusively male domain; citing Ada Lovelace, that the first arithmetic calculations were frequently performed by women, the calculators themselves being called computers, and the so called ENIAC girls from 1946 (Abbate, 2012 or Barkley, 1996). Despite these citations, sustained academic interest into the research of contemporary programmer culture is lacking.

Within the field of computer engineering, the issue of homogeneity has been addressed through political instruments such as gender quotas and diversity trainings. These instruments ideally establish structures that would allow for systematic irritations from feminist ideas, but the structures themselves don't generate change either. Within a broader social discussion the lack of equal representation of women in tech and leadership was triggered by instances such as the publication of an anti-diversity text, written by a Google engineer (Conger, 2017). As Erica Joy Baker states in an interview, this anti-diversity memo, claiming that biological causes explain the underrepresentation of women in technology, is not surprising but a commonly represented opinion within the company (Zomorodi, 2018).

In 2015, an African American software developer tweeted that Google's photos service tagged photos of him and other African American friends as 'gorillas'. Google declared itself appalled and apologetically removed the label while working on longer-term fixes (Simonite, 2018). As Baker says, this technology is "not built for every person in the world, because it's not built by people representing every person in the world" (Zomorodi, 2018). As if proving this very statement, the image labelling software still returns no results for great apes and monkeys in 2018, so even more than two years later Google failed to develop a more sustainable fix to the original problem (Simonite, 2018). While such technologies, frequently described as a 'black boxes', may have the allure of having a will of their own that is beyond their creators understanding and control, they actually extend and outsource their creator's subconscious. Through this, deeply ingrained biases are transferred into technologies, and become trapped within them, since these technologies can't (yet) consciously overcome or suppress them. Reciprocally, these biases then become reintegrated into our psychological and social existence.

While technology companies invest billions of dollars to tailor their programming to adapt to social and psychological structures, to feed on and exploit deeply seeded human predispositions, the societal interest in their designers is appallingly disproportionate. This is accompanied by the lack of understanding that the general idea that an academic analysis or an artistic device can create targeted changes within the technological is flawed, even if that doesn't mean it is beyond having any influence. So if it's programmers, who bring the social and the technical world in touch with each other, shouldn't society, theory, art and politics be more in touch with them?

As Jannig (2014) states, cultural scientists such as Friedrich Kittler, who said "[t]here is no software", aim to overcome classical hermeneutics by materialising these hermeneutic discourses within computers, computational structures and their programming (Kittler, 1992). But these concepts won't help us to manipulate technology and its programming; they also won't aid in the transformation of the deeply ingrained biases within it.

The Xenofeminist Manifesto creates a proposal for the implementation of possible solutions and identifies technological annexation as a path towards liberation yet without the means to actually implement it. To ponder the relation of machines and humans, or the alliance or alienation between women and technology is very attractive. The idea of a techno-utopia, undermining oppressive and disciplinary power structures is historically a recurring theme fuelled by almost any profound technological innovation, whether it's the steam engine, the Internet, Artificial Intelligence or crypto currencies. Their actual societal impact shall not be undermined, yet this endeavoured fundamental change won't be carried out by cultural theorists. The studying, as Laboria Cuboniks (2014) points out, can be done scientifically; the technological manipulation however is within the realm of a different system. It's the structure of the technological system that needs to be changed as a prerequisite to allow for the system itself to be changed, and it is within the system that the change needs to happen and not something that can be directed from the outside. So if the elements causing unjust oppression can most effectively be manipulated through technology, can I be a feminist if I don't want to become a programmer?

References

Abbate, J. (2012). *History of Computing: Recoding Gender: Women's Changing Participation in Computing*. Cambridge, MA: The MIT Press.

Barkley, F. (1996). *The Women of ENIAC. IEEE Annals of the History of Computing* 18 no 3.

Baudrillard, J. (1989). Videowelt und fraktales Subjekt. J. Baudrillard et al. (eds.). *Philosophien der neuen Technologie: Ars Electronica*. Berlin: Merve.

Belfiore, E. (Dec., 1993 - Jan., 1994). Xenia in Sophocles' Philoctetes. *The Classical Journal*, Vol. 89, No. 2, 113-129.

Conger, K. (2017). *Exclusive: Here's The Full 10-Page Anti-Diversity Screed Circulating Internally at Google [Updated]*. Retrieved from https://gizmodo.com/exclusive-heres-the-full-10-page-anti-diversity-screed-1797564320.

Esposito, E. (1997). Interpenetration. C. Baraldi, G. Corsi and E. Esposito. *GLU: Glossar zu Niklas Luhmanns Theorie sozialer Systeme*. Frankfurt am Main: Suhrkamp.

Freud, S. (1930). *Das Unbehagen in der Kultur*. Wien: Internationaler Psychoanalytischer Verlag.

Kittler, F. (1992). There is no Software. *Stanford Literature Review,* 9, (1), 81–90.

Laboria Cuboniks. (2014). *Xenofeminism: A Politics for Alienation*. Retrieved from http://laboriacuboniks.net/

Lessig, L. (2006). *Code V2*. New York: Basic Books.

Luhmann, N. (2000). *Art as a social system*. Stanford California: Stanford University Press.

Marx, K. (1844). *Critique of Hegel's Philosophy in General. Economic and Philosophic Manuscripts of 1844*.

Simonite, T. (2018). *When It Comes to Gorillas, Google Photos Remains Blind*. Retrieved from https://www.wired.com/story/when-it-comes-to-gorillas-google-photos-remains-blind/.

Wagner, S.C. (2017). *Poietry, Challening Solitude and the Improbability of Communication*. Vienna: DeGruyter.

Wajcman, J. (2010). Feminist Theories of Technology. *Cambridge Journal of Economics*. 34. 143-152

Zomorodi, M. (2018) *Why we Need No Filter*. Note to Self. Interview with Baker, E. Retrieved from https://www.wnycstudios.org/story/no-filter-women-online/.

Author Biography

Sophie-Carolin Wagner investigates elaborately, works passionately, quotes vigorously, writes peripatetically, communicates epistemologically, but not exclusively insightfully. She is a vegetarian artist and researcher; guilty of melancholy and refraining from social media, understanding the lack of subversiveness of her own actions. Publications include "Poietry: Challenging the improbabilities of communication" (2017) and "Establishing the continuously Unfinished: The Institution as an Artistic Medium" (2017).

OMNI ANIMA

-holophonic transformation of indigenous Sami joik song into shared and embodied flesh

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Abstract

The collaborative OMNI ANIMA art project investigates how the traditional and indigenous expression of the Sami joik can be compiled, transformed, processed and shared through an interactive electronic sound installation. Based on indigenous art forms, the project impacts several areas both within culture and arts. One being joik as a tool to negotiate identity in a post-colonial perspective and a tool that has been essential in forming the idea of a sami nation, Sapmi, in Northern Scandinavia.

Keywords

Indigenous song, joik, embodied sound, somaesthetics, somatic sound, transformation of cultural heritage.

Introduction

The Sami joik (or yoik) is a distinctive way the Sami people of Northern Scandinavia use to sing. Originally the joik is understood as being endowed with magical powers and often associated with black magic and sorcery. [1] A specific element in joik, and a correspondence to Siberian shamanistic song traditions, is how the singer is not just singing a song, but becoming a vessel for the topic of the joik, often being elements of nature such as mountains, rivers, landscape and animals. In this way joik is representative of the attempt to build a two-way, primeval connection to nature. [2] [3] In a phenomenological perspective the joik aims at erasing the sensory boarders of one's lifeworld and immersing both singer and audience into an embodied and deeply communicative experience. Performing joik implies that one becomes simultaneously the object and subject of the joik itself. [4]

These are intriguing elements of a tangible heritage (the sound of joik) dealing with the intangible and fantastic world of shamanistic spirituality (their idea world). The open question is if joik achieves that immersive, embodied space of communication and spiritual state that is highly romanticized around it. In the context of electronic and digital art an interesting question then emerges: how to rework, transform, open and extend the experiences of the joik singer to the audience? How to apply interactive technologies to transform the performance and experience of shamanistic song into a shared, lived and embodied experience? This presents not just a technological challenge, but also one of cultural heritage. Joik is originally an oral tradition [5] and transforming it through modern and technological interfaces could be perceived as a kind of cultural heresy, one effect being detaching and distracting the audience away from the intended and cultural experience of the Sami song.

Figure 1. Haptic interaction with the electronically transformed and touch sensitive Sami drum.

The Project

The OMNI ANIMA project is an artistic collaboration around the joik performed by the Sami musician and throat singer Torgeir Vassvik. Inspired by the enchanted, mystical, even seductive sound of joik [2], the project investigates how the traditional and indigenous expression of the Sami joik can be compiled, transformed, processed and shared through interactive electronic media.

As described, joik'ing is about magic awaking. Based on traditional Sami joik, OMNI ANIMA seeks to create magical sound experiences in the cross-over between ancient shamanism and new technology. The ancient joik is transformed through interactive holophonic multichannel sound systems. Via a touch-sensitive spherical instrument, joik is composed into a three-dimensional world of sound in real time.

OMNI ANIMA seeks to put the audience in a state of trance like the noaiden, the Sami shaman, uses the joik to achieve. The traditional function of the trance is to send one's spirit on trips to other places and worlds. In a similarly inspired manner, the project's ambition is to create stimulating sound experiences that come alive in and through the audience. Hence, OMNI ANIMA's Latin title: 'Everything' (omni) and 'Spirit' (anima), that is, 'everything is spirited'.
The artistic ambition is to engage and convey to an audience what joik is meant to be: voices from another world. To achieve this, the joik is transformed and disseminated through the use of an interactive and encompassing multichannel audio system. OMNI ANIMA uses electronic media to enhance the bodily experiences of the music and make the most of the joik's voice power. The project is thus aimed at a new and sensorial identification with the joik's magic.
From a cultural perspective, the project seeks to enhance the dissemination of original forms of joik. How can new technologies contribute to the magic experience of traditional forms of expression? Here the project works towards joik being experienced as an intimate, rich and rewarding physical experience in itself and for all.

Joik as Inner Voice

The musical part of the project is about joik as a genuine and valuable artistic expression. What distinguishes the joik from other traditional singing is that joik is about getting spiritually one with what you are joik'ing at the moment. You are to become the joik. Torgeir Vassvik practices an older form of joik where one strives to become one's inner animal. When practicing joik, you are not joik'ing about something or anyone, but you are joik'ing them. In his joik, Torgeir becomes the animal, the attribute or the soul he joiks.
OMNI ANIMA intends to recreate and strengthen such a trance-like experience. By placing listeners directly into a physically encompassing, interactive, multi-channel audio room (holophonics), the voice of the joik is communicated to the audience. Through holophonics the listeners themselves are dressed in the spirit of the animal.

Holophonics and embodied sound

Holophonics is a general term for the perception of sound in very realistic ways [6], often inducing auditory illusions as if the listener is at the source of the music or being embodied inside it. [7] Several holophonic, surround sound systems and solutions have been built and presented in recent years. [8] Comparative and relevant sound systems to Omni Anima range from NOTAM's new lab project on holophonic sound [9], to the SPIRAL lab at University of Huddersfield [10], to the AlloSphere Research project [11], to Natasha Barret's work on immersive spatial sound installations [12]. In the context of electronic media art projects such as Solve et Coagula utilize interactive, embodied and somatic sound. [13]

Figure 2. The Sami drum as the interactive centerpiece of the installation.

Joik as Somatic Sound

Omni Anima takes a phenomenological approach to art by investigating how the world of our experience is constituted for us. Phenomenology is here understood according to Heidegger's notion of intentionality as a form of being-in-the-world [14], underlining how embodied action shape our perception. This phenomenological approach to the body's fundamental importance sets the living corps right at the core for both understanding and experiencing sensory immersive experiences.
Such a sensory approach to sound is also related to the evolving field of Somaesthetics. [15] This is representative of an interdisciplinary research approach devoted to the critical study and ameliorative cultivation of the experience and use of the living body (or Soma) as a site of sensory appreciation (aesthesis) and creative self-stylization. This focus on the Soma as an epicentre of action is a fundamental, but often neglected somatic dimension of experience- and interaction design.

The Installation

Both practitioners and listeners are placed in an enclosed, multi-channel and holophonic sound room consisting of 12 speakers distributed around the audience, controlled by a custom built, Max MSP sound controller system. Through a touch-sensitive drum, the practitioner influence the direction and intensity of the joik. The joik heard is based on pre-recorded and -composed audio material. This pre-recorded joik can at the same time be divided into multiple and multi-dimensional voices rotating around the space and the audience. The installation attempts giving the sound a material like quality and physical presence that can be interactively tweaked by listeners to provide an intense sensation of physical sound. The purpose of this is to give everyone a part of the joik's inspiring ritual. The technology represents a translation of the joik into new forms of presentation and introduces new rituals for the affective and physical experience. Technically, the project is a continued development of the Norwegian sound lab Notam's previous work on ambisonics and holophony. [16] [9]
This interactive element enhances the direct, bodily and dynamic impact of the sound. This type of physical sound requires multiple speakers. The 12 speakers making up the experiential sound space of OMNI ANIMA envelopes users in a sound cloud with defined directions and volumes. The sound surrounds everyone present as a physical and spatial experience. Through interactive and bodily sound, the project creates a sensual and experiential space of joik within each participant.

Transformation of indigenous artefacts into electronic instruments

The Sami drum is central to performing joik. Omni Anima transforms the drum by fitting it with new, electronic and proximity sensitive sensors in gold. (Figure 1.) Electronically refitted the drum resumes and extends its role as an interactive, magical musical instrument. The capacitive resistance technology behind the project gives the drum a sensitive skin that detects not only how the surface of the drum is hit, but further how far or near users are to it even without touching. (Figure 2 & 3) For example, the volume of the installation is adjusted by measuring the hand's or fingers distance to the drum skin. The type of sensors used senses the user's proximity accurately from 0 to 30 cm distance, enabling the triggering and application of new types of rhythms and tonalities.
The project so contributes to new and holophonic ways to both compose and experience joik. Holophony in combination with interactive voice / audio source control makes it literally possible to dress the concert room with embodied sound experiences.

Outlook - Joik as a Cultural Weapon

Based on indigenous art forms, OMNI ANIMA impacts several areas both within culture and arts. One being joik as a tool to negotiate identity in a post-colonial perspective and –not to forget- a tool that has been essential in forming the idea of a sami nation, Sapmi, in Northern Scandinavia. [17] It is out of the scope of this paper to further a critical assessment of the highly interesting, but problematic issue of using cultural weapons such as joik in the forming of nations. The purpose of this presentation is limited to point to how traditional, indigenous artistic expressions such as joik can be transformed, processed and embodied into the flesh through interactive electronic media and audience participation.

Figure 3. Simultaneous multiple-user interaction with the interactive drum.

References

[1] Rapport, N. (2010). *Human Nature as Capacity: Transcending Discourse and Classification*. Berghahn Books. Tord Larsen, p. 166
[2] S. Kraft, T. Fonneland, J. Lewis. (2015). *Nordic Neoshamanisms*. Springer.
[3] Hutton, R. (2007). *Shamans: Siberian Spirituality and the Western Imagination*. A&C Black.
[4] Minde, H. (2008). *Indigenous Peoples: Self-determination, Knowledge, Indigeneity*. Eburon Uitgeverij B.V. p. 348.
[5] Thomas Hilder. (2014). *Sámi Musical Performance and the Politics of Indigeneity in Northern Europe*. Rowman & Littlefield.
[6] Fox, Barry. (1983). *'Tomorrow's Sound' is a blast from the past*. New Scientist. 1983. Vol. 98,Nr. 1352, p. 24.
[7] Stanislav Grof. (1985). *Beyond the Brain: Birth, Death, and Transcendence in Psychotherapy*. SUNY Press. P. 82.
[8] nn. 2017
[9] Notam, Norway. (2018). www.notam02.no
[10] Huddersfield, University. See http://www.hud.ac.uk/courses/full-time/undergraduate/music-technology-bahons/facilities/
[11] Allosphere. See http://www.allosphere.ucsb.edu/

[12] Barrett, N. Sevaldson, B. (2011) *Sound and architectural immersive spatial installations.* Barely: part-1 and part-2. *Site of Sound 2 anthology.* Berlin: Errant Bodies Press. 2011, pp. 223-242.
[13] nn. (2010)
[14] Heidegger, M. (1978) *Being and Time*. Wiley-Blackwell.
[15] Shusterman, R. (1999) *Somaesthetics: A Disciplinary Proposal*. The Journal of Aesthetics and Art Criticism, Vol. 57, No. 3. (Summer, 1999), pp. 299-313. Stable URL: http://links.jstor.org/sici?sici=0021-8529%28199922%2957%3A3%3C299%3ASADP%3E2.0.CO%3B 2-W
[16] nn. 2014.
[17] Bjørklund,I. (2000) Sápmi - Becoming a Nation: The Emergence of a Sami National Community. Samisk etnografisk fagenhet, Tromsø museum.

Author Biography

Stahl Stenslie: artist, curator and researcher specializing in experimental art, embodied experiences and disruptive technologies.

His artworks challenge our ordinary ways of perceiving the world. His practice asks the questions we tend to avoid or where the answers lie in the shadows of existence. Artistic keywords are somaesthetics, unstable media, transgression and the numinous. The technological focus in his works is on the art of the recently possible - such as panhaptic communication on Smartphones, somatic sound and holophonic soundspaces, and open source, disruptive design for emerging technologies.

He has been exhibiting and lecturing at major international events (ISEA, DEAF, Ars Electronica, SIGGRAPH). He has moderated various symposiums like Ars Electronica (Next Sex), ArcArt and Oslo Lux.

He co-founded The Journal of Somaesthetics https://journals.aau.dk/index.php/JOS and is the editor in chief of EE – Experimental Emerging Art magazine www.eejournal.no

His PhD on Touch and Technologies: https://virtualtouch.wordpress.com

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Towards a Semi Living Materiality: Biomaterials and Sensing for Wearable Interfaces

Nancy Veronica Morgado Diniz, Frank Melendez

Abstract

Bacterial living tissues operate in a symbiotic ecosystem with the external environment. This research question Can we draw inspiration from their behavior to design and manufacture body skins that can adjust to variations in internal metabolic processes? This project investigates the use of bacteria cellulose with 3D printed bodily anatomies literally grows a series of 'body architectures' developing a framework for architecture as an interface and extension of the human body achieved through the implementation of biofabrication processes and sensing technologies that utilize and integrate internal body signals and atmospheric flows in determining body-machine-environment relationships.

Keywords

Wearable Design; Physical Computing; Bio Fabrication; 3D Printing;

Introduction

Several technologies are converging to drastically change local and global spatio temporal relationships, including autonomous robotics, cyber-physical systems, ubiquitous sensing networks, and synthetic biological systems. These technologies provide architects and designers with opportunities to redefine models of human-machine-environment interactions that encompass more complex methods of simulated intelligence and nuanced response across a range of scales from the micro to the macro. This project explores the physical territory between the body and the environment—exploiting definition of 'spatial skins' (Figure 1) that are designed from inside-out of the body using the following design process:

1. Biofabrication Process_This research uses bacterial cellulose,as a means of growing biomaterials for architectural membranes. This provides opportunities to calibrate ecological systems that reduce the waste of local resources.

2. Sensing Technologies_We propose potential wearable applications that utilize and integrate biometric data (heart rate, electro dermal activity, brain electrical activity) and atmospheric flows (temperature, light) in determining body-machine-environment relationships.

Background

Many designers and artists have explored the notion of augmentation, projection or expansion of the human body skin (Cruz and Spize, 2005). This project is informed by a rich artistically and filmic lineage, ranging from the hybrid forms of 16th century Bruegel, Louise Bourgeois, Patricia Piccinini's and the visceral aesthetics in David Cronenberg work, most vividly the flesh formations of the game-pods in the 1999 film eXistenz. A visionary artist, Stelarc has studied different ways of altering the body (Teyssot 2005) in order to adjust and extend 'its awareness to the world'. The amplified body thus calls for remapping the body, by remapping, reconfiguring and redesigning the body by building on their work considering the expansion of human skin as a living landscape without a true limit or contour, and instead, part of a symbiotic ecosystem between the body's internal organs and the external environment.

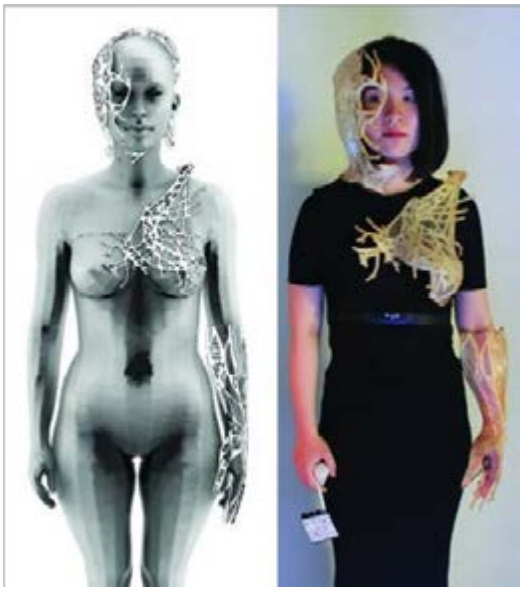

Figure 1: From left to right: Rendered image and photo of 3 Wearable Devices

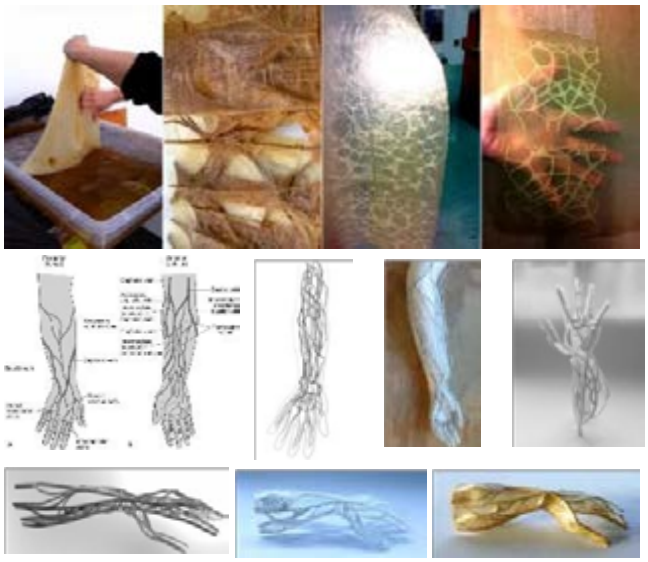

Figure 2: Stages of the fabrication process, bacterial cellulose growth and harvest; drawings, 3D doodle prototypes, 3D PLA plastic print, and a photograph of the bacterial cellulose clad prototype.

Design Approach

This project draws inspiration from the behaviour of bacterial living tissues, and our question is: can we grow, harvest and manufacture body skins as responsive layers that can adjust to variations in internal metabolic processes as part of a symbiotic ecosystem between the body's internal organs and the external environment?

The design process start by literally growing the material and materializes three 'body architectures' (Figure 2) developing a framework for architecture as an interface and extension of the human body achieved through the implementation of biofabrication processes and sensing technologies that utilize and integrate internal body signals and atmospheric flows in determining bodymachine-environment relationships. This project presents a novel architectural design research into machinic instruments that emerge as morphological responses to biotic and abiotic phenomena at the interface of bodies and spatial ecological systems across a variety of scales. This includes the design and production of a series of small scale wearable devices that operate as liminal mechanisms, creating a dynamic boundary between the body and the environment through the use of biometrics and environmental data. In this scenario, inhabitants of buildings are not treated solely as users acting within a static built environment, but as stakeholders that hold agency, and act as catalysts for an architecture that can adapt to changing materials, environmental or ecological demands. These technologies alter our ability to imagine constructed systems in highly nuanced relationships between internal bodily signals and surrounding atmospheric data, requiring an expanded view of networked and object oriented relationships between bodies, designed devices, and regional and global environments.

The Material and the Biofabrication Process

This research utilizes bacterial cellulose, as a means of growing biomaterials for three wearable devices. Microbial cellulose has proven to be a remarkably versatile biomaterial and can be used in a wide variety of fields, to produce for instance paper products, electronics, acoustics, and biomedical devices.We experimented with the strains from *Acetobacter*, in particular *Acetobacter Xylinum* bacteria being the most common and efficient type to use for a series of experiments and material testing samples. This particular strain is used to make Kombucha tea. The ingredients necessary for biofabricating the bacterial cellulose, are water, tea, sugar and vinegar. The spinning of cellulose is achieved through the fermentation process of bacteria, glucose, and oxygen within water.Nanofibers of cellulose are spun by bacteria into layers, forming a mat on the surface of the water, the material sheets grow on this aquatic environments in iterations of 3 weeks which can be removed and dried to produce a translucent sheet of material. Synthetic biological processes offer the potential to grow materials into specific forms and shapes for the biofabrication of architecture. (Figure 2).

Mapping, Modeling and Fabrication of the body devices

We have adapted a strategy of creating form from the inside-out, mapping and projecting body internal processes that would materialize into second skins connected with different biometrics sensing on each piece. We decided to couple the following body parts with biometric relationships:

A – Arm piece: Cardio vascular system with Heart-rate sensing

B – Chest/Back Piece: Organs and Muscles Anatomy with Dermal Activity (Stress Levels)

C – Head piece: Cardio vascular and organs with Brain Activity

Each piece senses bio-data in realtime and actuates it differently through the user interaction with it.

Drawing the Body

We started by developing analogue filament wired models by using a matrix of points, developing anatomical scaffolds and placing them in the selected body parts (Figure 3) In the second stage of form finding, we mapped in 2D body systems like cardiovascular, nervous, muscular and organ systems into a full body mannequin and with a 3Doodler pen we drew the 3D body shapes into three wearable pieces. (Figure 2). The 3Ddoddler prototypes were then modelled in Rhino and the digital models were generated using NURBS and Subdivision modelling techniques in Rhino and Maya, beginning with a series of curves that were based on biological information of bodily organs, as a means of creating the primary exoskeleton structure. A secondary structural pattern geometry was computationally generated by developing a script in the node based algorithmic editing software, Grasshopper (Figure 3). The script is designed to emphasize the primary structure by using the initial curves to create the boundaries of a dense,

secondary set of curves. The control points of these curves are distorted using a series of attractor points located along the primary curves. This results in a curve network pattern which functions to provide additional volume and space for embedding sensors and hardware, while creating a range of densities and enhancing structural support. These curve networks were used to create NURBS surfaces which were combined into a single mesh using ZBrush. This allowed the geometry to blend together as a single, continuous polygon mesh surface, for visual continuity, as well as rapid prototyping various models using additive layer manufacturing technologies.

Sensing Technologies

The project integrates physical computing methodologies through the use of code, microcontrollers and sensors, that measure biometric information, including heart-rate, thermal activity, and brain activity. This includes the use of coding in Python and Javascript, Ardunio and BITalino microcontrollers, and Electrocardiograph (EKG) sensors, Electrodermal (EDA) sensors, and Electroencephalography (EEG) sensors, respectively. Each of the three prototypes are embedded with hardware and focus on a specific biometric by allowing users to connect the sensors to specific locations within their bodies (Figure 3). Biometric data is sensed and output through lighting, sounds and digital patterns that visually and auditorily express this invisible ephemeral phenomena.

Future Work

This is an on-going research that presents the potential architectural applications that utilize and integrate biometric data (heart rate, electro dermal activity, and brain electrical activity) and atmospheric flows (temperature, light) in determining bodymachine-environment relationships. In this scenario, inhabitants of buildings are not treated solely as users acting within a static built environment, but as stakeholders that hold agency, and act as catalysts for an architecture that can adapt to changing materials, environmental or ecological demands. These technologies alter our ability to imagine constructed systems in highly nuanced relationships between internal bodily signals and surrounding atmospheric data, requiring an expanded view of networked and object oriented relationships between bodies and designed spatial devices. Future development will aim at combining and merging the material and sensing components of the project. For example, instead of growing the material and then cladding it in a synthetic structure, we will look at a synchronous process of growing and form making of the morphologies. Bio-printing technologies combined with bio sensors will allow a more seamless integration of living material and synthetic matter.

Figure 3: Design and fabrication process of the chest piece wearable device: anatomical diagram, digital model, 3D print on the MakerBot Replicator Z18 printer, final 3D print, bacterial cellulose clad prototype, and final prototype of wearable device with sensors and hardware integration. Photograph of the physical prototype consisting of 3D printed parts, bacterial cellulose, sensors, and hardware. Screenshot of the script generated pattern.

References

Armstrong, R. and Ferracina S. Ed (2013) Unconventional Computing: Design Methods for Adaptive Architecture, Designed and edited (with Rachel Armstrong). Published by Riverside Architectural Press.

Araya, Sergio, Ekaterina Zolotovsky, and Manuel Gidekel (2012) Living Architecture: Micro Performances of Bio Fabrication, In Physical Digitality: Proceedings of the 30th eCAADe Conference, 447-457. Vol. 2. eCAADe: Conferences 2. Prague, Czech Republic: Czech Technical University in Prague, Faculty of Architecture, 2012.

2009 Cruz, Marcos; Pike, Steve (guest-eds.). AD – Neoplasmatic Design, Wiley – 136 pages ISBN: 978-0-47051958-5.

Gama, M., Gatenholm P, Klemm, D. Edited (2013) Bacterial NanoCellulose: A Sophisticated Multifunctional Material, CRC Press.

Haraway, D. J. (1991) A Cyborg Manifesto: Science, Technology and Socialist-feminism in the late twentieth Century, in Simians, Cyborgs and Women – the reinvention

of Nature, Routeledge New York 1991. Hayles, K (1999) How we Became Post-human: Virtual Bodies in Cybernatics, Literature, and Informatics (Chicago: University of Chicago Press, 1999)
Teussot, G (2005) Hybrid Architecture: An Environment or the Prosthetic Body, SAGE Publications, London, Vol 11(4): 72-84

The Movement Undercommons:
Movement Analysis as Meaning Making in a Time of Global Migrations

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Keywords

Movement, migration, motion capture, annotation, repository, database, pattern analysis, open-source, translation, community, somatic movement.

Abstract

While migration studies are generally approached in geographical/statistical/geo-political terms [time, histories, routes], this project considers migratory movement at the scale of individual human movement. movement as a marker of identity expressed through qualities of posture, rhythm, gesture, tempo, orientation. Each person's movement is unique, an individual's movement 'fingerprint', and this project seeks to reveal and honor the specific, fluid, complex qualities of a people in motion of body and location, while adding to a critical discourse surrounding issues of contemporary migration. This is a position paper describing the research framework behind a new project which proposes an exploration of movement and mobility amongst internal migratory populations within two pilot areas; South Africa and Greece. This work develops our previous work [1] [Iyengar, V., Coleman, G. et. al. 2016], creating a repository for a growing collection of high-resolution motion-capture 'portraits'. This repository will not only hold the source documentation of movement sequences, but also serve as an open platform for those recorded. It will become a space for discussion, creative interpretation, translation, annotation, and analysis. The repository opens a public space for artists, researchers, dancers, ethnographers, humanists, and somatic movement educators to respond and add diverse layers of meaning; creative interpretation, social and historical context, and technological and somatic analysis. Thus, we build an expandable platform for exploring the linguistics of movement through a range of responses.

Introduction

Cultural identities can be said to be emergent of movement, and can be clearly and immediately recognized from extraordinarily small and sparse sets of digital information. As kinesthetic data 'portraits', this information can contribute to visualizing individual and group narrative in new ways, including narratives of migration, typically approached through statistical or textual study. Human movement is intrinsically expressive, and can convey affective, visceral understandings of another. And because digital movement information can at once represent the specific movement patterns of an individual while remaining an abstraction, it has the power to express an intimate and sensorial image of human effort and engagement.

Recent advances in movement capture technology (mocap) allow for the translation of human movement into digital data. If we imagine that the field of dance can include a range of everyday movement, mocap technology can extend an exploration of human movement at dimensions of scale, space, and the instantaneous simultaneity of networked information. This project proposes a situated approach for sourcing and capturing movement data that incorporates and foregrounds environmental, cultural, technological, economic and historical contexts in which our movement is inextricably embedded to approach legacies of expulsion, displacement, migration, diaspora, and dense cultural diversity.

As one of the goals for this research is the development of an open-source digital movement repository built in collaboration with a diversity of communities, the process of both data *collection* and *use* is of the utmost importance. Issues of cultural (and physical) appropriation are rampant and complex in the histories of marginalized communities, continental Africa and the Diaspora, and digital technologies can be easily used to propagate these injustices. At the same time, we seek to record people and patterns who are typically not documented, to find alternative ways to embody those who have not been seen.

We re-purpose Ivan Illich's concept of 'vernacular work' [14] here to refer to those everyday forms of dance and organized movement that are informal, refractory (resistant to formal analysis), yet are socially reproduced and derived from commons. The project challenges the notion of digital neutrality and investigates movement vernaculars through the development of a computational approach that highlights both similarities and differences, thereby revealing the specificities of each individual mover.

Pilot Applications

To investigate this proposed work, we take on applications through two unique invitations. The first is a month-long workshop residence in collaboration with LATRA [2] an innovation design studio in Lesvos-Greece organized in

response to the European refugee crisis. LATRA has established a technology driven makerspace in the KARA TEPE Refugee Camp in Lesvos-Greece, where it implements innovation-led, open source projects directly on the field, and advocates for the equitable development of beneficiaries through STEM learning programs. In this case, in response to refugee requests for opportunities to 'get their stories out', we propose several workshops in motion capture technology, somatic movement, and storytelling either at the KaraTepe Camp or off-site in the Mytilene area with community members whose identities, professional and life experiences overlap or include: refugee, aid-worker, local, dancer, designer/engineers, educator. The workshops will result in co-created, community controlled data/movement sets to visualize and tell stories of contemporary diaspora and migration. These workshops, scheduled for summer/fall 2018, will be one among multiple nodes of this larger project on movement capture and migration to develop methods and best practices.

The second invitation is a longer-term residence as a guest lecturer at the University of Pretoria, South Africa. In this case, we approach the legacy of Apartheid's embodied identitarian regimes, rich history of migration, and dense cultural diversity. In conversation with scholars at the university, we will broach questions such as: how does the history of forced removal such as that of District Six in the Cape - or the creation of group areas that forced people into certain racial areas and out of others influence the ways bodies move in the present? We will explore specific issues of internal movement in South Africa, such as the necessity of South Africans to travel long distances for work every day, resulting in a hundred thousand minibus taxis taking more than ten million predominantly black South Africans to work. Or, the influx of 'foreigners' or other Africans into South Africa, how they are segregated, and how their movement around the major cities differs from others.

Through accessing specific movement patterns and investigating how specific patterns of movement —such as labor, dance, sickness, traveling— are embodied - and how that embodiment changes over time in contemporary post-Apartheid South Africa. The research looks to incorporate a nuanced history of movement that is creative, voluntary, coerced, and create an open-source digital movement repository built in collaboration with diverse communities who will develop the processes of data collection and determine its use.

This work is being planned in collaboration with faculty and artists at University of Pretoria, providing an excellent setting for this research. The pedagogy and current research there covers similar conceptual terrain, with multiple opportunities for equipment and resources, shared communities, and curriculum development. These networks will be extended while in Durban, as we have begun conversation with several colleagues at UKZN, Durban.

A Cultural Database of Motion / Prior Work

Our capacity to recognize and distinguish amongst different kinds of movement —animal, human, animate, inanimate— is a crucial evolutionary ability as basic as breathing. It is rarely reflected upon unless that ability is damaged or lost. Relatively new, powerful, and robust motion capture systems are continuously advancing to demonstrate more and more ability to capture the density of details that render data to reflect the holistic aspects of human movement, along with the unique signature that each one of us carries like a fingerprint. As such, cultural specificities can be said to be emergent of movement, and can be clearly and immediately recognized from extraordinarily small and sparse sets of data.

The collection of digital data will result in quantitative and qualitative information. While databases of gesture, pedestrian movement and dance certainly exist [3,4,5], technological procedures in current motion capture data are, by definition, processes of reduction and separation. Instead, this project proposes to document the deeply embedded, unique, non-neutral movement vernaculars with recognizable cultural personalities. Certain formal styles of dance are culturally connected to concepts of frame and plane in a Cartesian grid space—e.g. Western European classical forms and the notation systems that ensued. Complex movement forms emerging from non-European vernaculars and other 'new world' diasporic movement traditions have often defied written notation for a host of technical, socio-political and cultural reasons.

There currently are several examples of open source libraries of motion capture data [2,3,4], as well as many projects utilizing motion capture data [5,6]. The open source libraries tend to focus on either simple useful gestures (running, walking, jumping) intended for use by game developers, or on the motion capture of complex choreographed forms of professional dance. Motion capture data sets such as the *Open Motion Project* at ACCAD [3] set out to make available motion data for video games, animation, etc. On the other side of the spectrum, *Motionbank.org* [4] has created a ". . . network of choreographers, dancers and researchers interested in using MoSys for their own purposes", with the stated aim of "translating choreography and dance into new digital forms." A notably different project leveraging motion data is *White Glove Tracking* Project [10] that creates an experimental framework for not only annotating the motion in a video, but also providing a community platform to highlight community responses in which crowd sourcing data sets relate to human movement and dance. Another repository that provides storage, visual browsing and annotation of motion capture data set is the RepoVizz [1]. It has a highly-advanced user interface that allows easy navigation through a tree-based structure of multi-modal data streams and rendering of real-time data through WebGL.

Our project aims to direct the power of community analysis not at a single highly choreographed performance

or online video, but rather at a wide range of movement vernaculars that we encounter around the world in our everyday lives.

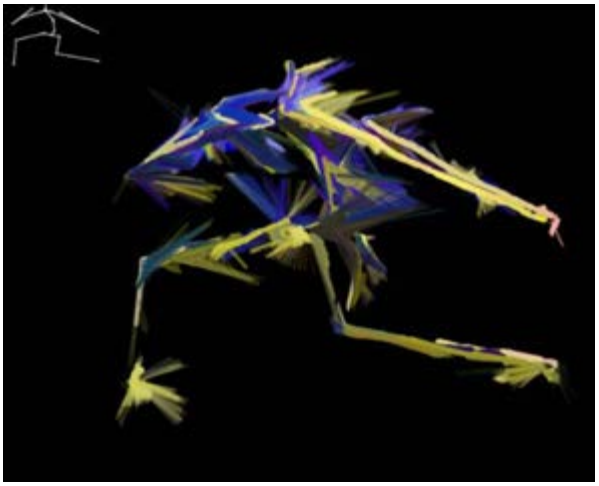

Figure 1. Example Motion Capture content visualized by Jennifer Wieler.

As one of the goals for this research is the development of an open-source digital movement repository built in collaboration with a diversity of communities, the methods of both data *collection* and *use* is of utmost importance. Issues of cultural and physical appropriation are rampant and complex in the histories of continental Africa and throughout the Diaspora, and digital technologies can easily be used to propagate these injustices. At the same time, we seek to record people and patterns who are typically not documented, to find alternative ways to embody those who have not been seen; are there patterns of movement in specific groups such as black domestic workers, dancers, miners, college students?

Addressing the field of contemporary human geography, Derek McCormack asks; "Where might a discussion of the relation between dance and geography begin?" [11]. In the study of human movement and migration, this research asks; What might be revealed in recording, mining and comparing culturally distinct movement lexicons? What could a platform for the development of a *linguistics* of movement that considers form and context provide?

Approach

In our system, movement sequences are recorded as stretches of improvised/indeterminate movement, so that the development and dynamics of the movement vocabulary do not suggest a finite beginning and ending, as in a gesture library, and create a rich capture space to be observed and analyzed across multiple dimensions. This approach suggests that movement is expressed as decisions over time, and that the critical, somatic, physical principles display compositional intention significant to the meaning of the movements overall.

Generally speaking, somatic education emphasizes creating conditions for more efficient, functional movement patterns to emerge [8,9]. Yet it is also understood that patterns of habitual movement are, at any given moment in a person's life, an accumulation of who, where, and what the person has done and where they have been in their lives [10]. Our research shows that an individual's repetitive patterns of movement are often extraordinarily 'high fidelity' – in that the digital representation of that movement can be successfully recognized with small amounts of data.

Sourcing movement material will begin with local dance practitioners. We will create prompts with interpretable parameters around axes of rhythm, space, and duration with subjects across a diversity of styles and approaches. In sourcing movement material, of particular interest are forms that emerge 'spontaneously' from collective, informal, situations such as social dancing at clubs or parties, skateboard parks, community sports, and so on.

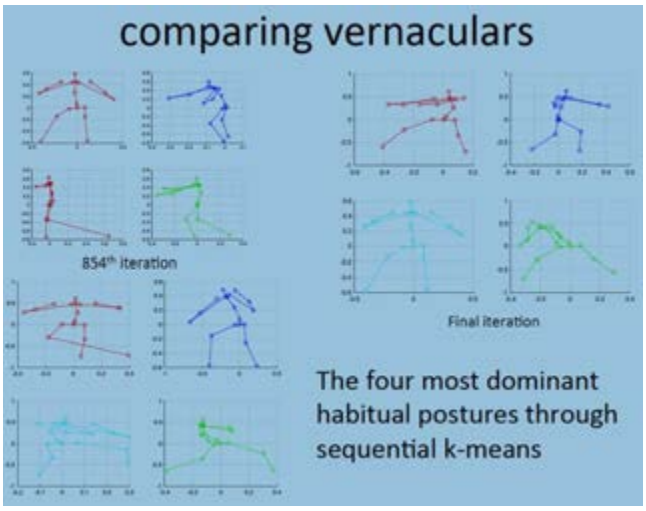

Fig 2. *Comparing Vernaculars* from " Motion, Captured: An Open Repository for Comparative Movement Studies,"

It is a great challenge to collect and evaluate movement data without dissolving into reductionist methods. Much work has already been completed in this field to establish a methodology that uses advanced motion capture techniques and data analysis to clearly show complex and compelling individual movement patterns (Iyengar, V., et.al. 2016). In this work, a motion capture system was used to track movements of dancers from a variety of cultural backgrounds. Data was analyzed and simple, graphical/video models were constructed to show patterns of movement. This information was shared and discussed with participants who gained insights into how their personal cultural histories informed their movement patterns.

Data can be analyzed using existing MATLAB tools in development through a joint project between ASU's School of Arts, Media and Engineering, and the Fulton

Schools of Engineering, that utilizes streaming variants of k-means to detect motion clustering patterns. This process has been demonstrated in the initial research project. (see Figure 2).

Ultimately, the motion tracking will be conducted using simple, customizable on-body electronics, possibly encased in culturally sensitive jewelry or garments that engage the participants in the process, enabling them to become invested in their own movement patterns and data.

System Hardware

The next level of 'field' prototyping will be conducted using the Notch (https://wearnotch.com/), a 3-dimensional, modular motion tracking system incorporating accelerometers, GPS positional sensors, and Bluetooth LE (BLE) transmission capabilities. The modules, weighing less than 8 ounces each, are attached to the body via special straps. They are also waterproof, which is a key consideration in on-body electronics. This modular BLE system provides a new level of flexibility in how the movements may be captured, and does not require the use of a specially facilitated dance research venue.

The sensors track movement and can be used to evaluate composite, complex movements through the Notch SDK developer's toolkit. For example, a minimal movement dataset could consist of positional and 3D movement data from the chest, hip, right upper arm, left upper arm, right thigh and left thigh. Additional modules can be incorporated. (see Figure 3)

Fig 3. Sample image from data collection using the Notch devices as used in ASU Arts, Media and Engineering AME 494 Somatic Prototyping class, April 2018.

Outcomes and Dissemination

The primary outcome will be an online open source repository as outlined above. It will be freely accessible resource for scholars, artists, dancers and performers to understand, and represent the cultural and contextual components of movement. Using this as a resource, the repository will be used to create further opportunities for public engagement and scholarship around the work, namely: a touring exhibition of the work and scholarly publications.

We envisage individual movement patterns as a kind of fingerprint that is unique for each person, having ties to movement habits that develop over the course of a lifetime and are heavily influenced by cultural context and geography; a kind of ontogenesis of movement patterns. The repository will become increasingly important to create connections between individuals and groups who have been displaced through political, environmental and economic forces at play in the 21st century. South Africa is selected as a starting point for this work because of the dense and diverse cultures and movement patterns that permit rapid development and deployment of the repository. Further work will be possible in global regions such as the Eastern Mediterranean and Oceania where significant population movements are increasingly driven by political and environmental factors.

Exhibition: Digital movement portraits will be envisioned as a multi-media installation work; a sonic and visual multi-channel media installation created with a series of data movement portraits. The Center for African Contemporary Arts and Culture, The Academy of Advanced African Studies [University of Bayreuth, Germany] and Goldsmiths University of London seek to curate and support the work that evolves from this project, while seeking other relevant art-science-technology venues. The exhibited digital movement portraits will be developed through a collaborative activity encompassing visual and sound artists and developed using interactive media tools such as Cycling'74 Max/MSP.

Acknowledgments

We thank Assegid Kidane, students of AME 494 Somatic Prototyping, and the faculty, staff and students of the School of Arts, Media and Engineering and School of Dance.

References

1. Iyengar, V., Coleman, G. et.al., "Motion, Captured: An Open Repository for Comparative Movement Studies," *MOCO'16* July 5-6, 2016.
2. LATRA https://www.latra.gr
3. The Ohio State University. ACCAD - Motion Capture Lab - Data and Downloads. "Open Motion Data Project". **http://accad.osu.edu/research/mocap/mocap_data.htm**.
4. Motion Bank. http://motionbank.org/de.
5. CMU Graphics Lab Motion Capture Database. **http://mocap.cs.cmu.edu/**.
6. Panopticon: http://www.cs.cmu.edu/~hanbyulj/panoptic-studio/ Panoptic Studio: A Massively Multiview System for Social Motion Capture Hanbyul Joo, Hao Liu, Lei Tan, Lin Gui, Bart Nabbe, Iain Matthews, Takeo Kanade, Shohei Nobuhara, Yaser Sheikh, ICCV 2015.
7. DCU Tennis Sensors (using fast portable IMU's)

1. https://www.irishtimes.com/news/science/technology-pros-serve-tennis-ace-1.945491
2. https://pdfs.semanticscholar.org/67d7/7d699a384a4a6912685ed579928daf4ad416.pdf
3. http://ieeexplore.ieee.org/document/6127084/
4. Project Tango -https://get.google.com/tango/ - for Mobile Based Kinetc
5. Fit3d and others offer portable 3d scanning - https://www.fit3d.com
6. Daniel Vlasic, Rolf Adelsberger, Giovanni Vannucci, John Barnwell, Markus Gross, Wojciech Matusik, and Jovan Popović. 2007. Practical motion capture in everyday surroundings. ACM Trans. Graph. 26, 3, Article 35 (July 2007). DOI:https://doi.org/10.1145/1276377.1276421
7. Ronit Slyper and Jessica K. Hodgins. 2008. Action capture with accelerometers. In Proceedings of the 2008 ACM SIGGRAPH/Eurographics Symposium on Computer Animation (SCA '08). Eurographics Association, Aire-la-Ville, Switzerland, Switzerland, 193-199.
8. Wang, Q., Turaga, P., Coleman, G., and Ingalls, T. Somatech: an exploratory interface for altering movement habits. In *CHI'14 Extended Abstracts on Human Factors in Computing Systems*, ACM (2014), 1765–1770.
9. Feldenkrais, M. 2010. Embodied Wisdom: The Collected Papers of Moshe Feldenkrais. North Atlantic Books, USA
10. Buchanan, P. A., and Ulrich, B. D. The feldenkrais method R: A dynamic approach to changing motor behavior. *Research Quarterly for Exercise and Sport 72*, 4 (2001), 315–323.
11. Evan Roth, Ben Engebreth. http://whiteglovetracking.com/
12. McCormack, Derek P. (2008) *Geographies for Moving Bodies: Thinking, Dancing, Spaces.* Geography Compass, Blackwell Publishing Ltd. 2/6 1822–1836
13. Repovizz: A multimodal on-line database and browsing tool for music performance research., 2010.
14. Illich, I. Vernacular values. *Philosophica 26* (1980).

Bibliography

1. McCormack, Derek P. (2008) *Geographies for Moving Bodies: Thinking, Dancing, Spaces.* Geography Compass, Blackwell Publishing Ltd. 2/6 1822–1836
2. Johannesburg: the elusive metropolis, Editor(s): Sarah Nuttall, Achille Mbembe, [Transformation: Critical Perspectives on Southern Africa, Number 71]
3. The Ohio State University, Advanced Center for Computation and Design [ACCAD] - Motion Capture Lab - Data and Downloads. "Open Motion Data Project"
4. Motion Bank. http://motionlab.deakin.edu.au/dr-scott-delahunta/, Centre for Dance Research, Coventry University (UK)
5. Carnegie Mellon University, Motion Capture Database, http://mocap.cs.cmu.edu/
6. Smigel, Libby, and Martha Goldstein. *Documenting Dance, a Practical Guide*. Washington, D.C.: Dance Heritage Coalition, 2006
7. Guest, A. H. (1977). *Labanotation: Or, Kinetography Laban : the system of analyzing and recording movement* (Third edition, revised.). New York: Theatre Arts Books.
8. C. Desmond, Jane. *Embodying Difference: Issues in Dance and Cultural Studies*. (Winter, 1993-1994) ed. Vol. No. 26. University of Minnesota Press. Pp. 33-63.
9. Low, Setha M. (2003) *Embodied Space(s): Anthropological Theories of Body, Space, and Culture.* space & culture vol. 6 no. 1, February 2003 9-18, Sage Publications
10. DeFrantz, Thomas. *Exhausting Dance: Performance and the Politics of Movement*. TDR: The Drama Review, Volume 51, Number 3 (T 195), Fall 2007, pp. 189-191 Published by The MIT Press
11. Anderson, R.E. Social impacts of computing: Codes of professional ethics. *Social Science Computing Review 10*, 2 (1992), 453-469.
12. Zellweger, P.T., Bouvin, N.O., Jehøj, H., and Mackinlay, J.D. Fluid Annotations in an Open World. *Proc. Hypertext 2001*, ACM Press (2001), 9-18.
13. McCormack, Derek P., *Refrains for Moving Bodies.* Duke University Press Books, 2013
14. Nash, Catherine (2000) *Performativity in practice: some recent work in cultural geography.* Progress in Human Geography, Volume: 24 issue: 4, page(s): 653-664
15. Thrift, Nigel. (2008). *Non-Representational Theory*. Routledge.
16. Csordas, T. (1994). *Embodiment and experience*. Cambridge, UK: Cambridge University Press.
17. Africa Arts Consortium http://africaartsconsortium.org/
18. Phantasmal Media : An Approach to Imagination, Computation, and Expression, AUTHOR, D. Fox Harrell, PUBLISHER MIT Press, 2013-11-08
19. Kitchin, R. Big Data, new epistemologies and paradigm shifts,
20. Dourish, P. 2001. Where the Action is: The Foundations of Embodied Interaction. MIT Press, Cambridge, MA, USA.
21. Feldenkrais, M. 2010. Embodied Wisdom: The Collected Papers of Moshe Feldenkrais. North Atlantic Books, USA
22. Biped (1999), Retrieved from http://openendedgroup.com/artworks/biped.html
23. Sha, X.W., Freed, A., Navab, N. 2013. Sound design as human matter interaction. In CHI '13 Extended Abstracts on Human Factors in Computing Systems (CHI EA '13). ACM, New York, NY, USA, 2009-2018.
24. Corness, G., Schiphorst, T. (2013). Performing with a system's intention: embodied cues in performer-system interaction. In Proc. Creativity & Cognition (C&C '13) ACM, New York, NY, USA, 156-164.
25. Rowe, R. (1996). Incrementally Improving Interactive Music Systems, Contemporary Music Review, 13:2, p.47--62.
26. Schiphorst, T., Andersen, K. (2004) Between Bodies: using Experience Modeling to Create Gestural Protocols for Physiological Data Transfer. In: altCHI, CHI 2004, pp. 1-8.
27. Shamma, D., Scheible, J, Sheppard, R. (2009). Graffiti dance: interaction of light, information, and environment. In Proc. Creativity and cognition 2009. ACM, NY. 479-480.
28. Sheppard, R., Nahrstedt, K. 2009. Merging research modalities: TED (tele-immersive dance) collaboration offers a model for performance-based research and creative development. In Proc. Computational Creativity Support Workshop at ACM CHI 2009.
29. Schiphorst, T, Sheppard, R., Loke, L., Lin, C-C. (2013). Beautiful dance moves: mapping movement, technology & computation. In Proc. Creativity & Cognition (C&C '13), ACM, New York, NY, USA, 429-433.
30. Ghostcatching (1999), Retrieved from http://openendedgroup.com/artworks/gc.html
31. Codd, E.F. (1968). Cellular Automata. Academic Press, Inc., Orlando, FL, USA.
32. Reynolds, C. (1987) Flocks, herds and schools: A distributed behavioral model., In Proc. SIGGRAPH '87, 25–34
33. Coleman, G. 2013. Listening as the Land Talks Back: Ecology, Embodiment and Information in the Science Fictions of echo::system. Leonardo Journal. 46(3), 204-210
34. Birringer, J. 2008. After Choreography, Performance Research 13:1, 118-22.

35. Rowe, R. 1999. The Aesthetics of Interactive Music Systems. Contemporary Music Review, Vol. 18, Part 3, pp. 83-87.
36. Downie, M. 2005. Choreographing the Extended Agent: performance graphics for dance theater. PhD Thesis. MIT.

Authors Biographies

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Future Tripping VR Project - Immersive Data Visualization of Social Networking from the Arab Uprisings

Abstract

Future Tripping VR project offers new design approaches to data visualization while expanding our understanding of how the logic of digital computation influenced and shaped twenty-first century global social movements. The project's objective is to contribute to the increasing demand for understanding contemporary political speech, rapid social change, and data science drawing on social media and using the Middle East as a case study. Through critique of database narrative and shifting media practices during political, economic, and environmental shifts of the twenty-first century, this project articulates techniques of data analysis as a research method in media studies and the digital humanities. The central questions are "How can we create a virtual and augmented realities installation and software application that is cinematic using real-time social media?"; "How might an embodied approach to understanding the patterns of data humanize the scholarship?" Using a practice-based design methodology, our research cluster proposes to build a 360 degree, first-person immersive, augmented reality (AR/VR) production of the Arab uprisings of 2011 using a substantial archive of social media from the current version of R-Shief.

Keywords

Virtual Reality, Arab Spring, Social Network Service, Twitter, Facebook, Data Visualization.

Introduction

Due to the advent of mobile and network technology, most people in these days are carrying a data handling device such as cell phone, laptop or tablet, the speed of travel of the information is becoming more influential to public compared previous generation.

This flow of information does a critical role in a certain period. In the case of Arab Spring, the new way of propagation through wireless network showed that this influence of short and simple text-based information can be an excessive power of commitment that drives people's behavior toward change.

We recognized from the statistics after the massive "sandstorm," the data usage during this period skyrocketed. Especially, the number of active Twitter users in Saudi Arabia, it increased nine times a year from September 2011.[1] Furthermore, we were able to trace back to the usage of Social Network Service (SNS) by accessing these companies Application Programming Interface (API).

Building Data Collection System of R-shief.org

During the turmoil, our system R-Shief (r-shief.org), web server containing over twenty-six billion social media post (Twitter, Facebook, Instagram, YouTube, etc) in various languages, was able to collect massive Twitter data through the API. With all these data, we had to filter by the criteria based on our question of this project to offer meaningful data set to researchers.

Twitter is one of SNSs that communicate text-based information which is a powerful and straightforward way of appeal an opinion compared to the Facebook. Because of its unique structure, the speed of propagation certain issue between related people (followers) is expeditious. In addition, Twitter data always store the detail information of the sender, such as location, time, ID at the same time. This allows API users to collect tons of critical information to trace back the origin of conversation.

Based on the Twitter API, our project addresses momentous political and cultural dispute between people and countries in the Arab area. Our long-term survey related to the political issues in Arab countries, particularly on Egypt from the social media, our system offers multiple users a much-talked-about issue on various platforms by sorting

[1] Arab Social Media Report, Twitter in the arab Region (http://arabsocialmediareport.com)

Fig 1. screenshot of R-shief.org. from May 2009

thousands feed from them. The structure of our data mining system facilitates recognizing the language of a tweet based on its character.

Users who really want to read the most pressing issue at some point, they are visiting and searching related keyword through a search engine. However, the formal internet website doesn't offer the cross-platform comparison. Not like formal search engine service, our

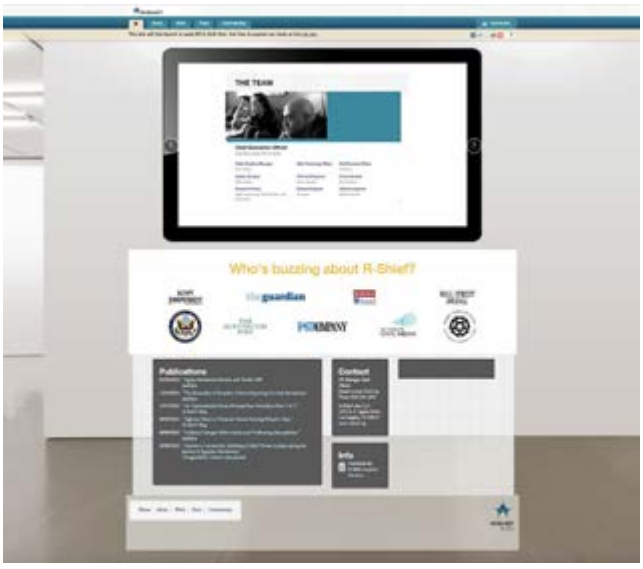

Fig 2. screenshot of r-shief.org. from Dec 2012

system R-Shief offers guidance to the user instantly to their greatest interest. The internal analyzing program in the system provides visualization of the data simultaneously to give a better understanding of the issue.

Fig 3. screenshot of R-shief.org. from May 2015

Furthermore, the advantage of R-Shief's real-time visualization system is that either the source of the data comes from Arabic and the region or the selection of the important keywords or tags can be modified by the users.

Interactive Design for Handling Massive Tweeter Data

There are still many services to analyze the impact of social media based on the API systems of each social media companies. Our application, which is different from the existing services, is that the user can process and reorganize the objectized data in virtual space in real time.

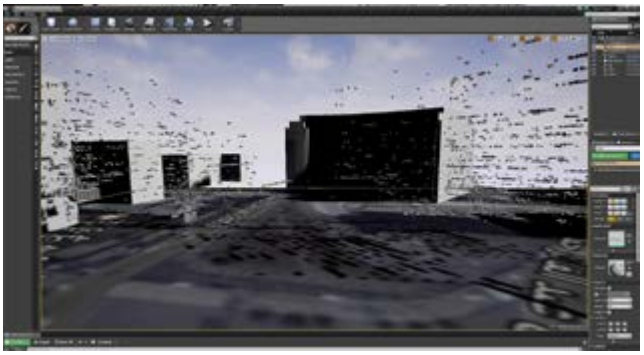

Fig 4. screenshot Arab Tripping VR project

Through a head mount display and the motion sensor, the user can sort, move, destroy and deliver these objected text data from our R-shief system. The data based on text objects are generated differently position, size, and color based on the local position and the number of released tweet data around the current position of the user (Tahrir Square). This makes user more recognizable tweet data compared to the 2D screen based data visualization.

To give a more realistic sense, we recreated the virtual space similarly to the current Tahrir Square. Our virtual space has day and night and reproduces various lighting effects and passages of automobile people.

Fig 5. screenshot Arab Tripping VR project, the second version

Conclusion

Our system is collecting and analyzing the amount of data from social media service from Arab countries since 2009 to serve researchers who are studying this topic filtered data with minimal effort.

We built a system that migrate collecting data to the VR space that can effectively classify and reprocess various data in real time. Unlike the numerical data that can be easily classified by a program, text-based data like Twitter is written in various languages need to be translated according to human interpretation. We have made the Arab Tripping VR project easy to apply each user's individual criteria to user's classification system.

References

Mourtada, Racha & Salem, Fadl. (2013) *Arab Social Media Report: Twitter in the Arab Region*, http://www.arabsocialmediareport.com

Abou-El-Fad, Reem. (2015) *Revolutionary Egypt: Connecting Domestic and International Struggles.* New York: Routledge.

Jamali, Reza. (2015) *Online Arab Spring: Social Media and Fundamental Change,* MA, USA, Chandos Publishing.

Herrera, Linda. (2014) *Wired Citizenship.* New York: Routledge.

Authors Biographies

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iPhotograms: An Exploration of Technology Through Cyanotype

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Abstract

Our technologies are becoming evermore ubiquitous and universal. Technology now composes our lives. At the same time, in a sense we become more separated from these technologies due to a lack of understanding of the hardware and software of which they are made. This paper introduces these ideas of the black boxing of technology through the lens of science and technology studies along with media archaeology. These ideas form the conceptual framework behind *iPhotograms*, a series of cyanotype photograms examining the black box of an iPhone 5. In this project, a modern camera, the iPhone, was disassembled, dissected, and documented using one of the oldest photographic processes.

Keywords

Media archaeology, science and technology studies, photography, cyanotype, historic photographic processes.

Introduction

Our technologies are becoming evermore ubiquitous and universal. As Roger Burrows explains, our social "associations and interactions are now not only *mediated* by software and code they are becoming *constituted* by it" (Burrows 2009). Technology now composes our lives. At the same time, in a sense we become more separated from these technologies due to a lack of understanding of the hardware and software of which they are made. We may understand the basics of a Raspberry Pi or simple coding, but much of the physical components composing and the underlying algorithms governing our smart phones, tablets, computers, watches, gaming consoles, and cameras remains hidden from view and outside the understanding of the average person.

This paper introduces these ideas of the black boxing of technology through the lens of science and technology studies along with media archaeology. These ideas form the conceptual framework behind *iPhotograms*, a series of cyanotype photograms examining the black box of an iPhone 5. In this project, a modern camera, the iPhone, was disassembled, dissected, and documented using one of the oldest photographic processes. This work peers into the inner workings of our technology and asks how much we can know or need to know. This paper will begin with an overview of the theoretical underpinnings of the project, introduce related work, visit the historic process of cyanotypes, and offer an overview of the *iPhotograms* series.

Exploring the Black Box

Latour discussed this black box in 1987, noting that 'cyberneticians' used the term when the physical components of a system or the set of commands in software became too complex. By black boxing the complex inner workings, they could focus on only the input and output (Latour 1987). Social constructivists revisited this idea, calling for the opening of the black boxes of our technology and exposing the systems and processes by which they came to be (Pinch & Bijker 1987). Some found this exercise to be unremarkable and without any insight, suggesting that theorists and philosophers need a better understanding of the technologies examined (Winner 1993). Others highlight how important understanding these social constructions are and how much human participation and interaction with technology depend on the way these systems are organized (Kallinikos 2002).

If we think of our technology as a combination of hardware, software, and wetware, then these ideas of the social constructivists begin to unpack the human (wetware) component of our technology (Winthrop-Young 2010). While social constructivist discussions around black boxes may focus on the hidden or underexplored social forces at play in the development and adoption of technology, others are examining the black box quite literally and physically.

Matthew Kirschenbaum describes electronic textuality, explaining that there is physicality to it even if it exists on a scale too small for us to normally consider (Kirschenbaum 2008). He explains,

Bits can be measured in microns when recorded on a magnetic hard disk. They can be visualized with technologies such as magnetic force microscopy... When a CD-ROM is burned, a laser superheats a layer of dye to create pits and lands, tiny depressions on the grooved surface of the platter. The length of these depressions is measured in microns, their width and depth in nanometers.

Media archaeology is also an approach researchers use to study new media and technology. Erkki Huhtamo and Jussi

Parikka explain the practice of media archaeologists as rummaging through

… textual, visual, and auditory archives as well as collections of artifacts, emphasizing both the discursive and the material manifestations of culture. Its explorations move fluidly between disciplines, although it does not have a permanent home within any of them (Huhtamo & Parikka 2011).

Hertz and Parikka later explore the possibilities of media archaeology as an artistic method. They draw on Latour's ideas of *punctualization*, of bringing a complex system together to serve as a single object. They look at the disassembly, or depunctualization, of these single objects and what this process means in our current paradigm of planned obsolescence of consumer electronics (Hertz & Parikka 2012). With products that are designed to be unfixable without serviceable parts, disassembling them becomes almost subversive. It involves opening up the black box that the manufacturers never wanted us to see or explore. DIY enthusiasts, tinkerers, and circuit benders all incorporate this idea of media archaeology in their practices of breaking open and modifying technology in engaging and expressive ways.

Related Work

Along with the concepts and ideas discussed thus far, *iPhotograms* is inspired and informed by a number of artists and researchers working with alternative photographic processes and digital photography.

Adam Fuss is one such artist who returns to historic processes as part of his work. This movement of the "antiquarian avant-garde" uses the history of photography for metaphors and insight in visually exploring the present (Rexer, 2002). Fuss incorporates the photogram in his work. Photograms are images produced with photographic processes but without a camera or lens (Neusüss 1994) often involving the placement of objects directly onto photosensitive paper. Barbara Tannenbaum interprets the photogram as a "conveyer of literal fact; the actual physical presence of the object or the light is recorded directly onto the paper" (Tannenbaum 1992).

In Fuss's series, *Love*, the light and chemistry of the photogram can be viewed as a metaphor for something spiritual, or metaphysical, something otherwise unseen or barely perceived. In this series, Fuss disembowels rabbits and arranges them on sensitized paper. In this literal dissection, exposure changes depending on the translucency of the various parts of the body, and the acids of the innards further impact the paper with rainbow effects (Modrak & Anthes 2011). I extend this idea by using photograms as literal fact to document the process of dissection by taking apart common technology and exploring what hidden or unknown information might be revealed during the process.

Trevor Paglen is a photographer who explores ideas of counter surveillance in his work, photographing things we are not supposed to see. Kafer (2016) discusses his Paglen's work *Limit Telephotography* that documents military bases from afar, noting that Paglen is exploring the limitations of photography in its ability to document government secrets or reveal truths or knowledge about information that is being hidden from the general public (Kafer 2016). Using lenses of up to 7000mm while shooting in the desert at night, the resulting images are blurred, vague shapes of vehicles and structures. *iPhotograms*, too, plays with this question of what we can actually know and document visually when powerful institutions, whether commercial or military, are in place to keep that information under wraps.

In their design research, Pierce and Paulos apply the idea of counterfunctional things to the digital camera. The two explore severely limiting the functions of the camera, such as an ultra-low resolution camera (some as low as 1x1, 2x3, 4x4) or a wooden camera that requires the photographer to saw open and break the enclosure (Pierce & Paulos 2014). These processes would render the images so abstract they would be unrecognizable or destroy the camera itself in the process. In my work with *iPhotograms*, I, too, explore the destruction of the camera as part of the photographic process and investigate the meaning that can be found within abstracted images or outlines.

History of Cyanotypes

The use of cyanotypes is not without meaning in *iPhotograms*, so I will briefly explain the history of the process. The term cyanotype comes from Greek, meaning "dark blue impression." Indeed, the result of this photographic process is a distinctive blue and white image. Sir John Herschel invented the process in 1842. Light interacts with ferric ammonium citrate and reduces it to a ferrous salt, which in turn reduces the potassium ferricyanide. The insoluble Prussian blue pigment, ferric ferrocyanide, is left as a precipitate. Areas not exposed to light stay in a ferric state, and the remaining unreduced salts wash off with water during the development process. As it dries, the ferric ferrocyanide re-oxidizes (Hirsch 2008).

Along with the development of the cyanotype process itself, the use of cyanotypes also has roots in technology and the sciences. Herschel used the process to duplicate intricate notes, and architects and shipbuilders used the process to create multiple copies of line drawings – literal blueprints. Anna Atkins is often credited with the first example of using cyanotypes in an aesthetic way. In 1843 she published the first book illustrated photographically, *British Algae: Cyanotype Impressions*. Given her background in botany and the careful cataloging of the algae images,

though, these illustrations seem more like documentation of various specimens rather than a purely aesthetic pursuit (Modrak & Anthes 2011). Indeed photography is an ambiguous "half-art, half-science" with constant innovations (Rexer 2002).

The Process of *iPhotograms*

The process of creating *iPhotograms* involved disassembling an iPhone and documenting the exploration with cyanotypes. This first involved obtaining the necessary equipment. I purchased the chemicals online via a craft supply website, the tool kit for smart phones at a specialty electronics store, developing trays at camera store, and paper and other supplies at an art store.

Once I had obtained the supplies, I prepared the solutions of Potassium Ferricyanide and Ferric Ammonium Citrate by adding water and waiting 24 hours to fully dissolve. When the solutions were ready for use, I mixed them in equal parts and applied the resulting sensitizer to the paper, which dried in my darkened bathroom.

While the paper was drying, I would sit at my desk in front of my laptop computer to watch a YouTube video on how to take apart the iPhone 5. These instructions, while quite basic in terms of their purpose, still offered an account of what each part of the phone was. After completing a step, I would pause to create an arrangement with the different pieces on my work surface. Once I settled on an arrangement, I would transport the pieces into the darkened bathroom and transfer them to the coated paper.

The next step in the process was exposing the paper in the sun. Given the cloudy and sometimes rainy weather, I would place the paper on a covered porch for anywhere from 45 to 90 minutes. During this time, I photographed the arrangement on the paper as it was developing to later use these photographs in the cyanotype process as negatives. Once the chemicals turned from a light green to bronze color, I would remove the phone from the paper and fix the image by agitating the paper in a tray of water.

I then repeated this process of taking apart the next section of the phone, arranging it, developing the photogram in the sun, and photographing this part of the process. Once the phone was complete disassembled, I printed the photographs taken of each step. These were printed on regular computer paper, rubbed with olive oil, and placed on top of chemical-coated paper to create a more detailed cyanotype. The printer negative and the paper were clamped between sheets of plexiglass and again placed in the sun to develop and fixed with water. I also began experiments with using macro photography to shoot extreme close-ups of the small parts with the intention of again using these as printer negatives for cyanotype prints. Further work will build on these detailed, macro shots.

Figure 1: Photogram from *iPhotograms*

Reflection

While the resulting images in the *iPhotograms* series may not offer a better understanding of how our current technology—photographic technology in particular—works, the process and the images do serve to illustrate various ideas and concepts around new media.

Perhaps one of the most surprising parts of the process to me was the difficulty of obtaining the necessary tools to take apart an iPhone. Certainly there were kits to purchase online, but most shipped from China with a delivery window that failed to meet necessary time constraints. Eventually I was able to find a kit through connections in the DIY community. This seemingly simple step nearly thwarted the timely completion of the initial tests, and it speaks to the ideas raised by Hertz and Parikka. Consumer electronics are not meant to be fixed or repaired, at least not by an untrained individual (i.e. an ordinary consumer). There are, as they noted, communities of people who tinker as I found through my investigations into local electronic supply stores and YouTube instructional video searches.

The process itself was also an exploration of the layers of black boxing technology as well as black boxing information. When first developing the project idea, I had a very clear notion that I wanted to explore modern cameras and photography by taking apart the necessary technology that many people today do not understand. As noted, there are so many complex systems in place that result in a single object that we use to take photos. Yet to take a photo today, all we have to do is take out our phones and tap the screen a few times. The simplicity of producing a cyanotype fits nicely with this idea of simply tapping to create an image. Two chemicals are mixed in equal parts with little possible hazard, and after that, all one needs is sunlight and

water. But much like the complex system that is involved with our ability to take a photograph simply by tapping our phone, a complex chemistry process is still the foundation of the cyanotype process. I admit that part of the reason I included the history and background of the cyanotype process in this paper is to remind readers how unfamiliar even natural systems may seem! This project questions how much we know or need to know about the black boxes of technology, but it also reiterates how much knowledge we have already put away into similar black boxes.

Figure 2: *iPhotograms* image using printer negative

Conclusion

In this paper, I discuss ways our current technology is hidden from our understanding and how difference scholars open, or at least tease apart, the complex systems that convert our inputs to outputs. I also look at other artists and researchers who are grappling with similar questions in creative ways and detail the photographic historical context for my artistic process.

This paper, and the *iPhotograms* series, is an exploration of modern camera technology in the spirit of media archaeologists. Using the cyanotype process to examine the literal and theoretical black boxes of our technology, this project builds on the work of other artists, academics, and researchers to question what we need to know and what we can know about the inner workings of the technology that constitutes our lives.

References

Burrows, R. (2009) Afterword: Urban Informatics and Social Ontology, in M. Foth (ed.) *Handbook of Research on Urban Informatics*, pp. 450–4. Hershey, PA: Information Science Reference.

Hertz, G., & Parikka, J. (2012). Zombie media: Circuit bending media archaeology into an art method. *Leonardo*, *45*(5), 424-430.

Hirsch, R. (2008). *Photographic Possibilities: The Expressive Use of Equipment, Ideas, Materials, and Processes*. CRC Press.

Huhtamo, E., & Parikka, J. (2011). *Media Archaeology: Approaches, Applications, and Implications*. Berkeley, US: University of California Press.

Kafer, G. (2016). Documenting the Invisible: Political Agency in Trevor Paglen's Limit Telephotography. *Contemporaneity: Historical Presence in Visual Culture*, 5(1), 53-71.

Kirschenbaum, M. G. (2008). *Mechanisms: New media and the forensic imagination*. MIT Press.

Latour, B. (1987). *Science in Action: How to Follow Scientists and Engineers Through Society*. Harvard University Press.

Modrak, R., & Anthes, B. (2011). *Reframing Photography: Theory and Practice*. Taylor & Francis.

Neusüss, F. M. (1994). "From Beyond Vision," Experimental Vision: The Evolution of the Photogram Since 1919. Denver Art Museum.

Pierce, J., & Paulos, E. (2014). Counterfunctional things: exploring possibilities in designing digital limitations. In *Proceedings of the 2014 Conference on Designing Interactive Systems* (pp. 375–384). ACM.

Pinch, T. & Bijker, W. E. (1987). The social construction of facts and artifacts: Or how the sociology of science and the sociology of technology might benefit each other. In W. E. Bijker, T. P. Hughes, and T. Pinch (ed.) *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, pp. 17-50. Cambridge: MIT Press.

Rexer, L. (2002). *Photography's antiquarian avant-garde: the new wave in old processes*. Harry N Abrams Inc.

Tannenbaum, B. (1992). *Adam Fuss: Photograms*. Akron Art Museum.

Winner, L. (1993). Upon opening the black box and finding it empty: Social constructivism and the philosophy of technology. *Science, Technology, & Human Values*, *18*(3), 362-378.

Winthrop-Young, G. (2010). *Hardware/software/wetware*. Critical Terms for Media Studies, 186-198.

Through the Aleph: A Glimpse of the World in Real Time

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Abstract

This paper presents the motivation, background, and implementation of *Through the Aleph: A Glimpse of the World in Real Time*, a net art project offering an unprecedented visual and interactive experience where many places on Earth and in space can be seen simultaneously in an instant. Built in an open source environment with live data, this project visualizes the diversity of human civilizations (microcosm) and the unity of humanity without borders in the ever-changing universe (macrocosm). With an unexpected approach to surveillance cameras and global networks it draws the connections between individuals and the global environment, Earth and outer space, eternity and time, and art and science. In a virtual world, this meditative web project merges multiple layers of dynamic imagery related to culture, cosmology, and technology in a globalized society into an abstract landscape. It not only embraces the dream of peace on Earth but also explores the bond between humankind and nature through time and space in the present moment.

Keywords

net art, web, real time, data, open source, media, interactive, webcam, surveillance, environment, multi-cultures, humanity, microcosm, macrocosm, literature, Aleph, Borges, space, time, coexistence, unity, peace, landscape, global, climate, networks, science, technology

Introduction

What Is an Aleph?

The letter Aleph is the first letter of the Hebrew alphabet, which symbolizes oneness and unity. Every letter in the Hebrew alphabet also has a numerical value, so the numerical value assigned to Aleph is one. On the other hand, the root of the word Aleph is also connected to many other words in the Hebrew language. The word *eleph* means a thousand; the word *aluf*, which also comes from the same root, means a (military) general or a champion. Thus, despite the fact that the letter Aleph only has a small numerical value of one, it also has connotations of greatness. (Hebrew Today, 2018)

In his short story *The Aleph*, Argentine author Jorge Luis Borges described that "an Aleph is one of the points in space that contains all other points" (Borges, 1970, p. 23)—the single gigantic instant where millions of acts in the unimaginable universe can be seen simultaneously from every point and angle. He later explained in the story that "for the Kabbalah, that letter stands for the *En Soph*, the pure and boundless godhead; it is also said that it takes the shape of a man pointing to both heaven and earth, in order to show that the lower world is the map and mirror of the higher; for Cantor's *Mengenlehre*, it is the symbol of transfinite numbers, of which any part is as great as the whole" (Borges, 1970, p. 29).

Rationale and Objective

As an avid traveler, the artist followed her curiosity to explore and study many places in the world. She has experienced diverse cultures and the beauty of nature, but also observed the lost wilderness, cultural globalization, and the growth of human population, while global tourism and global warming continuously increase.

Meanwhile, recent creative and research works by artists, such as Kurt Caviezel, Nye Thompson, and Pierre Derks, on live surveillance cameras and global networks (and how these emerging technologies affect people's privacy) have caught the artist's attention. Inspired by the life changing power of seeing Earth from space, she started to wonder: Where were the eyes of the Earth? How could we see the world in real time at a glance? How could she offer a different perspective on life using surveillance cameras? From then on the seed of this project was planted.

Borges' inspiring short story *The Aleph* influenced the artist to broaden the concept of this artwork. After 70 years, Borges' vision in the 1940s can be realized in this networked age—to visualize millions of acts from every point and angle in the unimaginable universe in a single gigantic instant. Through his perspective, we experience the totality and unity of humanity in the infinite space, which hopefully could hint at the brevity and fragility in life and raise questions about the reality of human existence. Although a real Aleph might never be found, the artist hopes that by observing humanity, Earth, and space from a distance this net art could stimulate deeper feelings and thoughts from the viewers.

"The trees of knowledge and of life grow together" (Lewis, 2010, p. 18). Although this project serves no practical and material end, it is an end in itself. It offers no purpose other than the joy of contemplation, the need of human consciousness, and the desire of knowledge. At the core of the creative process, the artist's gratitude towards life brought the projects alive using a universal language—visual art—and digital technology. Meanwhile, it evokes

certain emotions and sub-consciousness—a psychological phenomenon that involves a sense of life. In *The Aleph*, Borges mentioned a feeling of "infinite wonder, infinite pity" (Borges, 1970, p. 28). This is one of the sensations that the artist wants the viewers to experience through her work. Perhaps with humbleness and egolessness we stand closer to the greatness and wonders in Life.

Through the Aleph: A Glimpse of the World in Real Time visualizes a pair of opposites through the global reach of technology—the diversity of human civilizations (microcosm) and the unity of humanity without borders in the ever-changing universe (macrocosm). Although in recent times some creative and research works have used IP camera live stream and their linkage to the social environment also with the political scope to highlight the implications of this technological Panopticon, the artwork here presented utilizes surveillance cameras and global networks from a grand viewpoint to observe people, environment, and space within a philosophical and literary framework. It not only embraces the dream of peace on Earth but also explores the bond between humankind and nature through time and space in the present moment. Using live data to portray the Earth's pulse and human existence, this meditative web art creates an abstract landscape in an open source environment, reveals an emerging totality visible to the human eye through distant points of perceptions, and gathers all realities into the glimpse of the Aleph, where we could experience humanity as one in the unimaginable space—therefore, the unity in infinity (Figure 1).

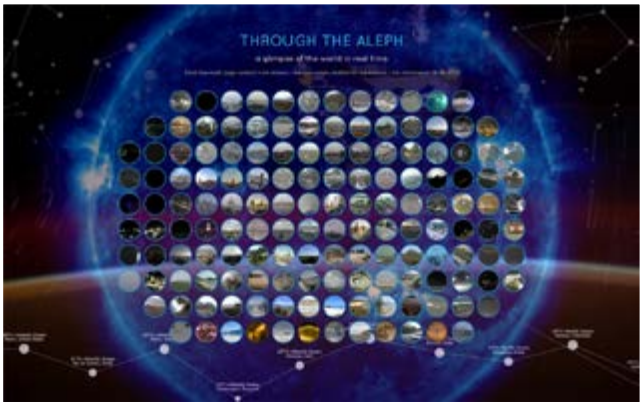

Figure 1. A screenshot of *Through the Aleph*. © Jing Zhou. (https://vimeo.com/189509112)

Making of the Project

Through the Aleph unites two entities—a net art and a time-lapse video. The net art was built with HTML, CSS, jQuery, JavaScript, and Processing, while the time-lapse video with Adobe After Effects. The webpage refreshes every six minutes automatically.

Edward Tufte, a pioneer in information design and data visualization, stated that "among the most powerful devices for reducing noise and enriching the content of displays is the technique of layering and separation, visually stratifying various aspects of the data" (Tufte, 1990, p. 53). Retrieving and collecting real-time data from multiple online sources, *Through the Aleph* interlaces live materials into three layers based on the "freshness" of the visual elements—the bottom layer holds static and dynamic graphics from the recent past; the middle layer displays near real-time data; the top layer generates real-time content.

In her well-known article *Grids*, art theorist and critic Rosalind Krauss pointed out that "logically speaking, the grid extends, in all directions, to infinity… by virtue of the grid, the given work of art is presented as a mere fragment, a tiny piece arbitrarily cropped from an infinitely larger fabric" (Krauss, 1979, p. 60). In *The Aleph*, Borges' literary conception of infinity poses a representational challenge as the artwork *Through the Aleph* is limited by a finite range of visual elements via webcam feeds and data visualizations etc. Hence, the artist created a grid mapping system to be the primary focus of this project, where Borges' boundless imagination could be reflected and presented using limited graphics and data.

The Bottom Layer

This background layer (Layer 1 in Figure 2) empowered by HTML and CSS covers the entire browser window with a three-minute looping video, which captures the views of our planet Earth from NASA International Space Station (ISS) from 2011 to 2015. In order to keep the background atmosphere dark enough, the artist composed this video based on twelve nighttime ISS footages from NASA's websites. These royalty-free footages include seven continents except Antarctica, because the artist didn't find footages of Antarctica during the time of making this project.

Within the top 30% of the webpage displays a transparent constellation map fading into the dark ISS video background. There are total twelve constellation maps stored online for this net art. All maps were captured based on the artist's home location—the New York metropolitan area—through the website of the Astronomy Club of the School of Physics and Astronomy and the Wise Observatory of Tel Aviv University in Israel. The original captured maps were colorful, complicated, and full of information unnecessary for this project. Thereby the artist simplified the maps and transformed them into a clean mono-color style. The twelve maps are synchronized with the twelve months of a solar calendar. Supported by JavaScript, the corresponding map is loaded automatically at the same location on the first day of the month.

Lastly, this layer holds a one-minute looping audio file invisible on the webpage, which produces the background sound—a white noise on low volume.

The Middle Layer

This second layer in the middle stores two visual elements enriched by near real-time data.

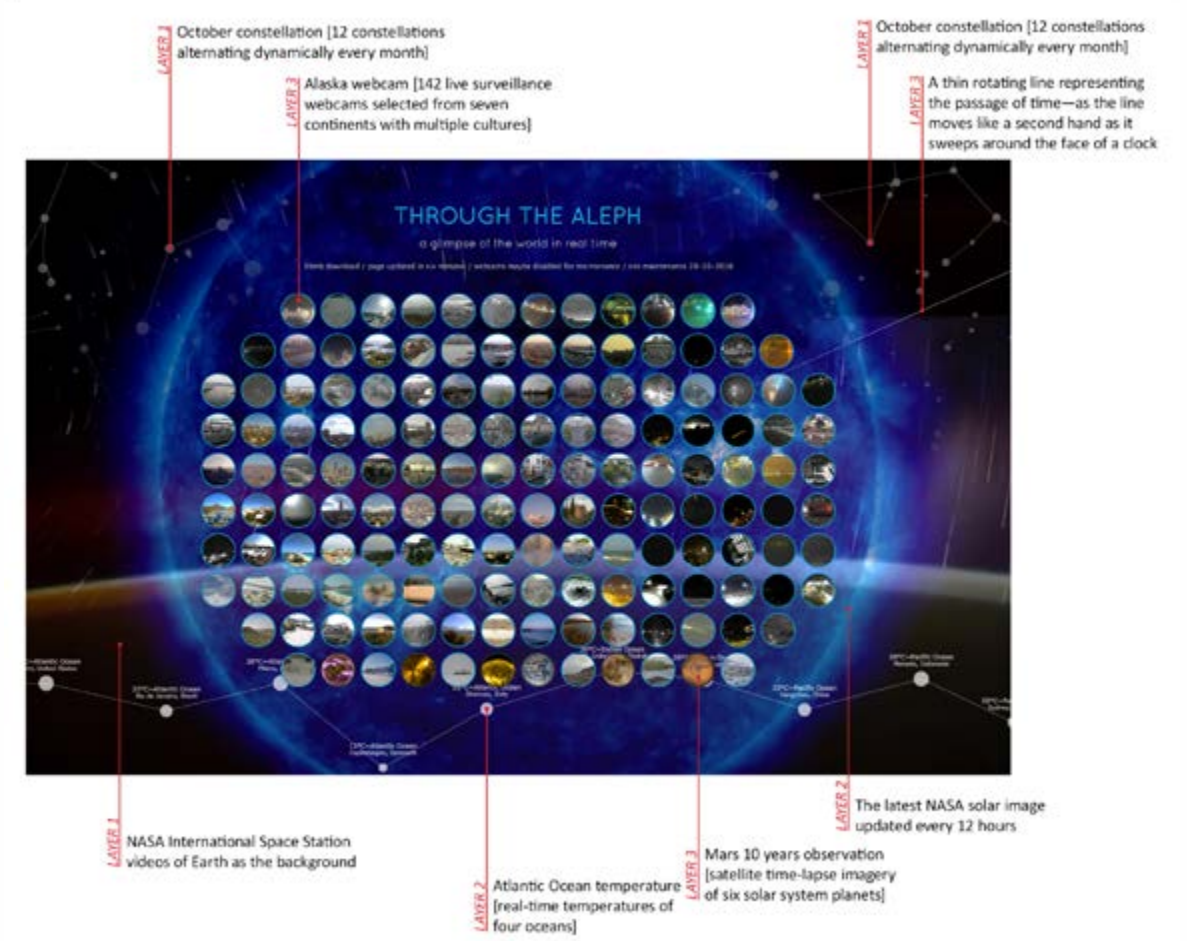

Figure 2. Diagram of *Through the Aleph*. © Jing Zhou.

At the center of the webpage resides a gigantic transparent blue sphere, shown in Figure 2. This is the latest solar image updated every 12 hours, provided by SOHO—Solar and Heliospheric Observatory, a project of international collaboration between European Space Agency (ESA) and National Aeronautics and Space Administration (NASA). This ever-changing image is retrieved dynamically twice a day from the SOHO website using HTML and CSS.

This royalty-free image is captured by SOHO's Extreme ultraviolet Imaging Telescope (EIT). All of the EIT images are actually produced by extreme ultraviolet (EUV) light from the Sun. EIT images are taken at four different wavelengths and four colors in order of wavelength (bluer—shorter wavelength, redder—longer) were assigned to represent each of them. (SOHO, 2018) The artist decided to use the bluest solar image in this project for three reasons. First, the Sun provides the primary source of energy to support life on Earth. Secondly, the deep blue color resembles the color of our planet Earth. Lastly, this very color matches well with the ISS video background, which enhances the aesthetic quality of the artwork.

Located at the lower portion of the webpage, the second visual element on this layer is a set of white dots. They represent the near real-time water temperatures of four oceans—Arctic, Atlantic, Indian, and Pacific Oceans—which play a crucial role in shaping the global climate change. Built with Processing, these dots linked by a thin white line are in gentle motion, which forms a wave line representing the ocean water. The diameters and vertical locations of the dots alter perpetually depending upon the water temperature data, which updates dynamically every few hours supported by the website of World Sea Temperatures. The artist selected twelve cities for the dots based on their latitude distributions and personal preference: Honolulu, United States; Miami, United States; Rio de Janeiro, Brazil; Pikine, Senegal; Copenhagen, Denmark; Siracusa, Italy; Dubai, United Arab Emirates; Mumbai, India; Hangzhou, China; Manado, Indonesia; Sydney, Australia; and Pevek, Russia.

The Top Layer

Layer three on the top hosts two overlapping entities generating real-time content.

Originating from the center of the web browser, a boundless thin white line rotates like a second hand as it sweeps around the face of a clock, shown in Figure 2. Programed in HTML and CSS, this line represents the passage of time; every 360-degree rotation indicates that one second has slipped away.

Embraced by the deep blue circle, at the center of the page lies the heart of this net art. Built with HTML, CSS, and jQuery, a carefully calculated grid mapping system is populated by 148 circular graphics. Among them are 142

live surveillance webcams selected from seven continents with multiple cultures and six satellite time-lapse imagery of the solar system planets. This grid system distributes the 142 webcam feeds—supported by OPAG Online Promotion AG—in accordance with the world map, shown in Figure 3. However, because the northern hemisphere has more countries and larger population than the southern half of the Earth, the northern hemisphere occupies seven of the ten rows, while the southern three.

When the viewer uses a computer mouse to hover over one of the circular webcam images, it enlarges gracefully to reveal a bigger size of the same image with a brief description of the webcam's location; when it is clicked, a popup box appears in the center of the same browser window and showcases the source website of that webcam. (Figure 4) This body of surveillance webcams needs frequent maintenances, because any webcam could be disabled unexpectedly due to various reasons at anytime.

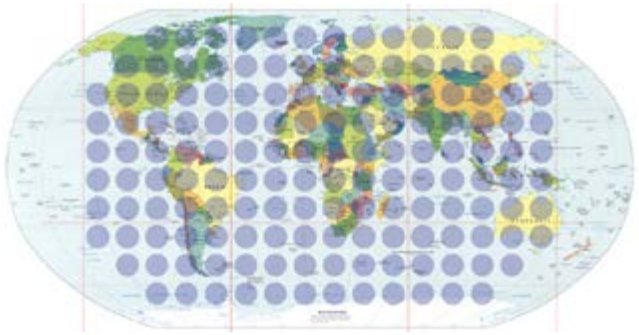

Figure 3. Webcams' Geographic Distribution. © Jing Zhou.

Figure 4. Two screenshots demonstrating the interactivity of *Through the Aleph*. © Jing Zhou.

The Time-Lapse Video

The video component of this project consists of twelve-day time-lapse screenshots of the net art in twelve months—one day per month—from September 2016 to August 2017. It captures not only the shift of day and night, but also the change of seasons—the infinite and transitory nature of life on Earth.

Installation

Through the Aleph can be presented on monitors and projection screens. (Figure 5) The background sound of the installation is white noise, which can be silenced during an exhibition, if necessary.

Figure 5. Installation shots of *Through the Aleph*. © Jing Zhou.

Conclusion

The net art project presented in this chapter connects the potential of digital technologies with literature, culture, and scientific studies, in order to create aesthetic and meaningful experiences for the viewers of various backgrounds. *Through the Aleph: A Glimpse of the World in Real Time* visualizes Borges' Aleph in the networked age and touches the core components that matter today: building an environment for consideration of data in cultural and temporal realms, presenting a visual framework in a literary context, and packing universal visual components and conceptual thinking into a limited presentation space. Furthermore, it translates the dynamic virtual landscape through new approaches to enhance human cognitions and perceptions of the universe and humanity of our time.

References

Borges, J. L. (1970). *The Aleph and Other Stories, 1933-1969: Together with Commentaries and an Autobiographical Essay*. New York, New York: E. P. Dutton & Co., Inc.

Hebrew Today (2018, April 15). *The Hebrew Alphabet - The Letter Aleph (א)*. Retrieved from http://www.hebrewtoday.com/content/hebrew-alphabet-letter-aleph-%D7%90.

Krauss, R. (1979). Grids. *October, Vol. 9 (Summer, 1979)*, 50-64.

Lewis, C. S. (2010). *The Abolition of Man*. Las Vegas, Nevada: Lits.

SOHO (2018, April 15). *Frequently Asked Questions (FAQ)*. Retrieved from https://soho.nascom.nasa.gov/explore/faq.html.

Tufte, E. R. (1990). *Envisioning Information*. Cheshire, Connecticut: Graphics Press LLC.

Author Biography

Born in China, Jing Zhou is an interdisciplinary artist, designer, and professor in USA. Her work has been shown and collected internationally including: Triennale Design Museum, Milan; Asian Cultural Center, New York City; British Computer Society, London; SIGGRAPH Art Gallery; ISEA; CAA; Les Abattoirs Museum, France; Mons Memorial Museum, Belgium; Royal Institution of Australia; Danish Poster Museum; GAMeC Modern and Contemporary Art Gallery, Italy; Athens Digital Art Festival, Greece; Taksim Republic Art Gallery, Istanbul; FILE, Sao Paulo; Korea Visual Information Design Assn.; Goethe Institute Alexandria, Egypt; Stanford University; public collection of the WRO Media Art Center, Poland; Waikato Museum, New Zealand; Moravian Gallery in Brno, Czech Republic; SDAI Museum of the Living Artist, San Diego; and Chinese Culture Center of San Francisco. [www.jingzhoustudio.net]

Transdisciplinary Collaborative Practices in Art, Science and Technology

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Abstract

The present panel seeks to problematize what constitutes transdisciplinary collaborative practices in contemporaneity. We will examine their increasing emergence; their methodologies, their challenges and propositions, and what it means to work jointly and why it is important. The aims of this panel are to open discussion on facillitating creative collaboration between different areas of knowledge; on heightening social inclusion in scientific and technological development; and on stimulating pertinent collective local actions based on transdisciplinary collaborative work. We intend to discuss some practices and methodologies used on the development of an artistic board game about the city of Salvador, Brazil; to describe the alternative forms of financing culture characteristics and explore what they can contribute to fostering the cultural commons, while also pointing to possible developments and new collaborative financing forms that can evolve in the future; and to question how we can really and effectively develop innovative and useful ways to do research and apply our findings having a creative approach. Thus, we look to dialogue based on the multiplicity and diversity of expression inherent in the minor and the socially micro-political which differ from identity posturings that are polarized and proprietary and which serve the interests of totalitarian development models.

Keywords

Collaborative Practices, Transdisciplinarity, Art, Science, Technology, Community, Commons, City, Game Practice, Experimental Transdiscipline.

Introduction

Andreia Machado Oliveira e René Smith

The present panel seeks to problematize what constitutes transdisciplinary collaborative practices in contemporaneity. We will examine their increasing emergence; their methodologies, their challenges and propositions, and what it means to work jointly and why it is important. By incorporating this panel in the *Hybridisation and Purity* subtheme, we focus our concerns on the intersection of practices in art, science and technology.

In order to problematize what constitutes collaborative practices in contemporary art and its transdisciplinary engagements, we adopt a procedural and paradoxical position towards activities which embroil the collective and the singular, the global and the local, or the mental and the embodied. The positional strategies are based on the multiplicity and diversity of expression inherent in the minor and the socially micro-political which differ from identity posturings that are polarized and proprietary and which serve the interests of totalitarian development models.

We propose three issues to be considered: how do methodologies of collaborative practice come about within emergent transdisciplinary relations (often in workshops with shared projects)? how to deal with joint authorship in which the artist/scientific researcher is not the author of the conception of the work, and less of its production, but still consider themselves co-creators along with the communities involved? and how does the documentation, distribution and dissemination of collective techno-aesthetic objects happen?

Aiming to differentiate between the Common and the modern idea of society, we look to mesh with the thought of theorists Gilbert Simondon, Bruno Latour, Antonio Negri and Michael Hardt whose works articulate concepts such as the transindividual, the collective and multitude and direct them to power the Common.

The Common refers to what is not in the public or private domain, but to the dimension of what is common to many. It is not linked to party organizations or established institutions, and does not organize itself spontaneously; it requires routine practices and organizational projects specific to each community and which involve the community—in other words, the common requires the constitution of specific practices proper to each community.

We ask what is the place of art, science and technology in the construction of the Common? How does one participate in the Common, in the transmission of transdisciplinary knowledge, in the dissemination of social experience? How does one position art in terms of producing an aesthetics of plurality and not one of universality?

Thus, the aims of this panel are to open discussion on facillitating creative collaboration between different areas of knowledge; on heightening social inclusion in scientific and technological development; and on stimulating pertinent collective local actions based on transdisciplinary collaborative work. We look to dialogue on how to share processes, not products; share singularities and not identities; produce difference and not more of the same in order to activate the powers of the collective.

From this point of view, this panel looks forward to contributions that enrich the problematization the theme in different ways: on the question of siting of art, science and technology towards the production of the common, author Lenara Verle, raises highly pertinent issues in "Towards a commons financing of art & intellectual commons"; with his focus on transdisciplinary practices, professor Ricardo Dall Farra in "Experimental Transdiscipline", brings previous experiences that think the relation between art and other disciplines; and to examine methodologies of collaborative practices, Karla Brunet discusses the development of an artistic board game in Salvador/Brazil, in "Collaborative game practice and the city". The objective is to generate informed exchange, relevant discussion, and applicable insights that lead us to think together how transdisciplinary collaborative practices are occurring today and how they may be put into action.

Collaborative game practice and the city

Karla Schuch Brunet

This panel intends to discuss some practices and methodologies used on the development of an artistic board game about the city of Salvador, Brazil. Having psychogeography and the art of walking as a starting point, we have produce a collaborative artistic board game. The game is based on the experience of moving through a place, in this case, the city of Salvador, and feeling its environment. It is an art game based on environmental aesthetics, *flâneur* and experiencing the city as art, as a game. It is the *Topophilia* popularized by Yi-Fu Tuan, to appreciate the place, loving it. Unlike a mere contemplation of the place, this project aims to raise issues of mobility, urbanism, environment, aesthetics and pollution. Here we discuss collaboration in three levels, on the creation and development of the game, on its playability - it is a cooperative game – and, on its replicability, anyone can copy the game or create his/her own, we published an open source GDD (Game Design Document) on how to construct one.

First, we had an open call for people interested in developing a game. People from different backgrounds and disciplines showed up to collaborate. They were invited to brainstorm, think about their territory and decide which parts of the city were important to be in the game. Later, we made field trips to these places to collect materials / experiences. The GPS trails of these outputs helped us create the map of the game board. Project participants photographed and drawn objects they found on these paths. These have become counters of the board game. Subsequently, the objects chosen as parts were modeled and printed on a 3D printer. We have competitive-cooperative goals and the movements of a player can deprive or rewards all players. The player in this game will be able to help another player, distribute their winnings, and donate their objects and experiences in the city. Collaboration here is mandatory to win the game.

"*Descaminhar*" is the name of the game. It's about leaving one's way, being a *flâneur*, and wandering. Many board games have the concept of a path, of going in a move. A large number of them have "movement" as the main action. Considering our own geographic spaces, experimental cartography and cognitive maps, we have created the main drawing of the board. At the same time, we thought about the strategies, objectives and problems to be solved during the game, always related to the city of Salvador. The objectives can be individual or collective. And the tasks can be related to enjoying the city, solving a problem, improving the situation or creating an experience.

The game consists of board, cards (challenge, narratives, events and item description), pins, 3D counters, time marker, tokens, and the box along with the manual. The board or modules of the game consists of places of the city of Salvador that need to be unlocked throughout the match. The 3D counters symbolize the items that each player achieves during the match, and the cards guide us to the movements to be made. All the material of *Descaminhar* board game can be download. We also encourage players to create their own board game, about their city or location that interested them.

After having done some game tests in different locations – lab, university, school, and art events – we perceived that this art game is a stimulus to practice and discuss collaborative action. In the beginning of the match, the great majority does not like or understand the cooperative goals. After the match is over, their attitude has changed; they are very open to collaboration. When thinking about environment issues and global warming, art is a great method for raising questions about our place, surroundings and collaborative practices.

Towards a commons financing of art & intellectual commons

Lenara Verle

We have today an artificial scarcity imposed on digital intellectual goods by way of DRM and copyright laws. Copyright evolved historically as a response to reproduction technologies such as the printing press and the phonograph. Since those times, authors faced a balancing act. In order to make a living from the sales of their work, part of the profits should find a way back to them through royalties and copyright practices. But too tight of a control might mean the work would not get distributed widely and therefore miss the opportunity to enrich and develop the culture in its full potential (not to mention the artist him/herself). This dilemma still exists. Art and culture is a type of commons and enclosures in the form of copyright laws harm our collective heritage and our access to this cultural wealth. On the other side, artists and authors need the means to live and produce their work.

Options for alternative forms of financing culture are emerging and being tested, making use of digital and networked technologies available in the present. This panel

aims to describe their characteristics and explore what they can contribute to fostering the cultural commons, while also pointing to possible developments and new collaborative financing forms that can evolve in the future. Some of the structures reviewed are: crowdfunding (from product reward only to alternatives highlighting the creation of commons), patronage (content-based or more geared to generating monthly income), cultural funds (and their forms of curation and governance) among others.

Authors have the choice to release their works with copyleft and commons-friendly licenses, and several initiatives are working to develop and refine such licenses in the framework of current national and international law. If new forms of collaborative financing can provide both the living means for artists and allow their work to be disseminated freely, enriching the global cultural commons, that can mean an end to the dilemma and a new paradigm for the distribution and access to culture.

Experimental Transdiscipline

Ricardo Dal Farra

Life is about communication and mutual understanding or disagreements. Humans have created systems and regulations in trying to understand how this world works, but we are far from finding answers to complex issues. The traditional academic structure based on rigid disciplines has proven not to work well to face problems such as climate change or poverty, naming here only two among many multi-dimensional challenges we are facing.

Can we really and effectively develop innovative and useful ways to do research and apply our findings having a creative approach? The solution to complex problems is being explored, increasingly, from multi and interdisciplinary perspectives. However, those strategies are not enough in many cases, and therefore developing a transdisciplinary approach becomes an essential tool.

There are different definitions about multi-, inter-, cross- and transdisciplinary research. The approach of considering transdisciplinary research as a way to create a unity of intellectual frameworks looking beyond a disciplinary perspective seems to be appropriate and useful also from the arts perspective.

It took centuries to build the complex system we have today for the teaching and learning of the various fields of knowledge, as well as to support the research that has been allowing us "to advance", at least in the terms that we understand it in our Western civilization. At the same time, it is necessary to recognize the different visions that people have of the world, and even if sometimes could be hard for us to understand or accept it, some of that can teach us and can be reflected in our academic or professional activity.

Art helps us to connect with the world or to isolate ourselves, to understand and embrace or to dissent, to make sense or to confuse, it can be an engine to free our creativity or to lock it. Art is linked to politics and economy, it can convey feelings and emotions, can also lead us to think about human biology or complex mathematical equations; it can apply principles of fluid mechanics and key elements from game creation, and can open new spaces, make use of very simple or extremely complex techniques, be based on serendipity, and navigate between the accidental or casual and causal, too.

We need to learn about crossing borders again and going beyond the limits, even if some of them are strong as walls. We should be able to understand different perspectives about the world and generate knowledge from a broader apprehension of reality.

The conceptual proposal of transdisciplinarity might be interesting to some but still too far from a possible practical implementation. Some examples of activities developed considering a transdisciplinary approach follows. Activities that have been bringing art and disciplines apparently far from each other close enough to work from a unified but large conceptual framework:

(a) The Transdisciplinary Creation and Performance class offered by Concordia University in Montreal.

(b) The Transdisciplinary Workshop realized as part of the Interactive Design and Creation Master program at the University of Caldas, Manizales.

(c) The international symposia Balance-Unbalance that "bring artists together with scientists, economists, philosophers, politicians, management and policy experts, sociologists and engineers from across the world with the intent of engendering a deeper awareness and creating lasting intellectual working partnerships in solving our global environmental crisis".

Art as an engine of change, as a key element that adds and helps to build the web of life. The route of uncharted territories, where certain signs could open new paths or stop us, following our experience and desires but also according to the way we see, we listen, we act.

References

Attali, J. (1977). *Noise. The Political Economy of Music*. Translated by Brian Massumi, 1985. United States: University of Minnesota Press.

Bollier, D. & Helfrich, S. (2017, April 18). *The Wealth Of The Commons: A World Beyond Market and State.* Retrieved from http://wealthofthecommons.org/sites/default/files/the_wealth_of_the_commons.prc

Dal Farra, R. (2015). Breaking Paradigms: Electronic Arts & Humanitarian Actions. *Balance-Unbalance 2016*. Colombia. Retrieved from: http://www.balance-unbalance2016.org/docs /Dal_Farra_BunB_Breaking_Paradigms_2015.pdf

Hardt, M. & Negri, A. (2004). *Multitude:* war and democracy in the age of empire. Nova York: Penguin Press.

Latour, B. (2012). *Reagregando o Social:* uma introdução à teoria do Ator-Rede. Tradução de Gilson César Cardoso de Sousa. Salvador - Bauru: EDUFBA – EDUSC.

Kreutzer, Till. (2018, January 04). *Open Content - A Practical Guide.* Retrieved from https://meta.wikimedia.org/wiki/Open_Content_-_A_Practical_Guide_to_Using_Creative_Commons_Licences/Introduction:_From_theory_to_practice

Oliveira, A. M. (2017). Arte e Comunidade: Práticas de Colaboração Implicadas no Comum. *PÓS:Revista do Programa de Pós-graduação em Artes da EBA/UFMG*. v.7, n.14, 42-60.

Negri, A. (2009). Para uma definição ontológica da multidão. *Lugar Comum,* Porto Alegre, n. 19-20, 15-26.

Neuwirth, R. (2011). *Stealth of Nations: The Global Rise of the Informal Economy.* New York: Pantheon Books.

Simondon, G. (1964). *El individuo y su genesis Físico-Biológica – La individuación a la luz de las nociones de forma y de información***.** 1 ed. Tradução Ernesto Hernández B. Paris: Universitaires de France.

Tuan, Y. (1974). *Topophilia*: a study of environmental perception, attitudes and values. New York: Columbia University Press.

"Performance Practices in Electronic Dance Music in the 21st Century"

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Abstract

The topic for this research paper examines the relationship between the human body and technologies used in live electronic music performances. By electronic music, it is proposed that any musical piece that claims to use sound produced electronically, electronic instruments such as synthesizers, or pre-recorded sounds. Performance of any piece of electronic music entails that it is constructed or produced on stage in front of an audience. By illustrating the aesthetics of early electronic music performance, it is easier to define what the performance aesthetics of the twentyfirst century are. These early practices have informed the vast majority of twenty-first century electronic music performances despite their limitations. The human body is discussed in relation to the history of electronic music and the performance practices of the twenty-first century. There is an increasing importance in performers being present and a critical part of the performance. Their active presence on stage gives electronic music a new meaning in terms of performance. The ontology of performers is no longer merely as a vessel for the music, but there are elements of theatre, dance and other disciplines that performers integrate into their performance.

Keywords

Electronic Music
Performance
Turnatablism
Synthesizer Technology

Introduction

The measure of a work of art is whether the person experiencing that art can sense the presence of the artist"s body. This sense comes from their mastery of their art such that it is not just their brain that conceives and realises it, but that every part of their being (muscles, arms, legs, hair and so on) is involved in its creation and realisation. The human body becomes a vessel for the art and not just the mind. When performing music then, the entire body is involved and it is not just the mind manipulating the instrument through the body. "When you give a performance that takes your body out of the mundane and into something extraordinary through art, it has profound appeal – this is the foundation of all performance" (Ostertag, 2002: 11). It is from this appeal and the rise of electronic music during the twentieth century that this research paper came around, fundamentally asking what the role of the performer is in electronic music? Musicians involved with electronic music today are not satisfied with the state of electronic music performance and the crucial missing element, namely, the human body. Likewise, audiences have particular expectations and expect to see as well as hear a performance and playing through loudspeakers is not performance. One of the appeals of all music is the magic of performance in real time for both the musician and the audience.

Post-Webern composers sought new compositional techniques and two particular techniques were developed. The composer could create "super-controlled" music that featured precise performance instructions or go the opposite routes and allow for an element of "chance" in the music. Chance music is music where the outcome is not predetermined and the performance is undefined. The results of these two divergent styles of composition can sometimes yield similar results as can be heard in early twelve-tone works of Schoenberg and the early electronic works of Pierre Schaeffer and Pierre Henry. Electronic music offers tremendous potential in both these spheres of composition. The composition can take advantage of a computer"s ability to perform tasks with mathematical precision and can be programmed to perform tasks at random. Technology has made this possible for composers. With technology advancing so rapidly and the number of controllable parameters increasing, the composer is capable of controlling just about every factor involved in the production of a sound. So they can create new, complex sounds and create complex rhythms that a computer can play perfectly each time, hence discarding the need for a performer at all. There are innumerable possibilities in terms of time, tempo, space, rhythm, density and form. The idea of live electronic music performance can be accredited to John Cage who from 1939 wrote music for electronic instruments (including equipment like radios and records with test tones on them). Principles he first used are still being used today in Electronic Music and in Electronic Dance Music. This paper will evaluate the history of Electronic Dance Music, the history of its performance and the role of technology. There are no universally accepted performance aesthetics in Electronic Dance Music, so this paper will also investigate the problems associated with this. The main aim of this paper is to introduce the performance practices of Electronic

Dance Music and discuss what is currently happening within Electronic Music as a whole.

EDM PERFORMANCE HISTORY

"EDM makes audible a present sonorous-motor event, more than any supposedly original past musical performance" (Dayal, G. and Ferrigno E., 2013) is how Ferreira describes EDM performance. Put simply, the performance of this music is intended to make people dance. Traditionally, a disc jockey (DJ) was in charge of EDM at a nightclub or a rave and their main performance technique involved mixing two 12-inch vinyl records on two turntables. The turntable was a DJs main piece of equipment and was the focus of experimentation in the era of "turntablism". The DJ constructed endless, continuous mixes for dancers. This idea of a seamless flow of music that continued all night came from disco. Their main purpose was to take the listeners and dancers on "a type of musical journey". They would be in charge for long periods of time so their performances (their sets as they are called within the genre) would have to take this into account and feature slower, mellower tracks as well as well-known, louder and faster tracks. The dance floor was both the source and the recipient of the music the DJ played and together, the music and the dance floor allowed for transmission of one through the other. This remains the standard performance practice of EDM today. But musicians have been experimenting since the 1950s to find new techniques and methods of performance. Two broad approaches were created and this paper will be exploring those.

The general availability of tape recorders and magnetic tapes after the Second World War stimulated electronic musicians. Initially composers would just play a tape of what they had recorded but the novelty of this had worn off by the mid-1950s and so composers (like Varèse, Leuning and Ussachevsky) began devising new ways of bringing human elements into electronic music performance. Two approaches emerged in combining electronic resources with live performance in the years after Schaeffer and Henry first started experimenting with *musique concrète*, namely "mixed music" and "live electronic music". Mixed music involved combining live instrument or vocal performers with a pre-recorded tape. This method of combining live and electronic elements embraced divergent aesthetics in that there were no limitations as to what either the performers could do or what could be recorded on tape. Live electronic music involved electronically modifying sounds produced by the performer, at the time of production, in a manner controlled by either the instrumentalist or another performer. Initially these techniques were used in a manner analogous to that of filmmakers working with film in that the music was largely "composed" through editing. By the end of the 1960s, there were a variety of techniques available (to change the spectral characteristics, spatial positioning, sound envelope shapes and echo and delay systems) for modifying the sounds produced.

This was a period of great innovation and experimentation for composers. Both these methods allowed for new, novel sounds to be created and heard. The idea of tape plus instrumentalist or vocalist was restricting to both performers and listeners as there was an element of predictability and no interplay between the two. The audience and the performer were dragged along by the tape and had to follow it rigorously. This method is still used extensively today but rather than magnetic tape, digital equipment is used. By the 1970s and 80s, micro processing was becoming more readily available and this allowed the birth of the personal computer. With the personal computer came digital technology. Digital technology was applied primarily through event processing and signal processing where music is represented digitally as streams or "note events". These were specified primarily by parameters such as pitch, duration and dynamic level (velocity of attack). This enabled composers to create and store files of these note events through devices such as synthesizers and samplers. The computer could now become a „performer" and "interactive composition" was possible, where performers and the computer could interact with one another.

The performer and the computer were free to improvise along a predefined set of rules placed by the composer. By the mid-1990s, minicomputers (and laptops) became cheaper and more practical as a live performance instrument. There were advances in technology and performers could influence various parameters such as dynamic and timbral constitution in real time. With the increasing processing power of computers came the ability for digital signal processing, "transformations of spectral and temporal aspects of sound quality – the major constituents of what we loosely call timbre" in real time. Both „event" and „signal" allowed for many possibilities in performance. Composers and performers were given new freedom. Performers could trigger and mix different sound files during the performance giving them greater control over synchronisation though a click track (a regular beat that enforces tempo and allowed for accurate cue entries).

This creates a problem for „live" electro-acoustic music. There is no agreement as to what constitutes it because the presence of a live performer cannot always be detected on a recording nor is there always a relationship between a physical gesture and an acoustic outcome. Issues of causality are clearly raised here on various levels: performer (for example a DJ) or an audience, sounds (EDM) or movement, humans or machines. Performers and audiences are a part of EDM performance just as much as music and dancing. These are all crucial aspects of EDM and are further highlighted in performance. The debate hinges on the causal role that humans and machines play in EDM performance.

TECHNOLOGY IN EDM

Technology as shown above plays a crucial role in the production of this music. Without technology it would not

be possible. Audiences and performers alike have a speaking familiarity with electronic music technology. Hardware has become standardised and performers display their hardware during performances, be it instruments, wires or lighting apparatus. The Roland TR-303 was the most famous bass synthesizer. Roland was, in many ways, the pioneers of EDM hardware during the 1980s. They created two of the most famous drum machines, namely, the Roland TR-808 and TR-909. These drum sounds are still prevalent today and EDM producers still sample these sounds in their music today. Amplification of sound is also crucial and this is done through a microphone, amplifier and a loudspeaker. The performer can control the amount of amplification through an electronic control generally called "volume" or "gain" and "tone" of the amplified sound can be controlled equalisation. Equalisation involves controlling the amplification of certain frequencies such as bass or treble frequencies. There are a variety of other dynamic effects that can be applied to the amplified sound such as tremolo (pulsing variations in amplification) and reverberation (an increase of *space* in which sound is heard).

Technology led to two different types of hardware devices to help create a more meaningful, musical relationship between the performer and the computer. The first followed and measured physical human action and these are commonly called "controllers". The second of these was used to analyse the acoustic result of a performance. Controllers follow human performance actions and translate this information into suitable representations that the computer can analyse and control separate sound equipment. These interfaces were first developed in the 1960s and were then mainly used to control analogues synthesizers and processors via voltage control. The development of MIDI in 1983 led to more controllers and different types of controllers as well. The most important of this new digital generation of controllers were those based on instrument types. These devices tracked and measured various physical actions that influenced sound production such as finger position, breathe pressure and strike velocity amongst others and generally they had no acoustic output. These could come in various forms such as wind, string or percussion controllers. Other controllers could the sound result of instruments and translated the measurements into control information.

Today, performance action controllers dominate the marketplace and are relatively reliable and cheap despite certain limitations (considerably less sensitive to performance nuances such as timbral variations). The influence of tape recorders on the very nature and definition of "music" was profound. The medium had a liberating effect its early users, namely, Pierre Schaeffer, Pierre Henry, Edward Varèse and John Cage. This was the first generation of composers to use sampling and today we have digital technology that can be used in conjunction with software to record and manipulate sounds. Then came works that featured tape and a live instrument. "Tape Music" had its roots in the film tradition and pre-scripted editing and montage rather than live performance. This made it an interesting way of presenting compositions and along with the DJ are the two main performance methods of EDM. DJs control dance floors though the use of turntables or musicians play along to a beat played by the laptop (which has replaced the tape). This approach allowed the performer to create real-time counterpoint though the use of effects such as echo. It is little surprise then of the affinity that this method has with jazz musicians as it allows for one of the most important parts of jazz to come out in its own, namely, improvisation. This affinity began in the 1960s when electronic and jazz musicians worked together, played their music to the same audiences and were both, to a certain degree, cut off from funding as corporate and institutional pressure rose in support of mainstream music. Improvisation within electronic music has been around since the early 1950s when it was explored by pioneers such as John Cage, David Tudor and Gordon Mumma. Improvisation within electronic music today has been made far easier by technology. On one piece of equipment (a computer), it is possible to control a plethora of effects ranging from ring modulations to delays. These are the parameters that the electronic musician is concerned with when improvising, namely the spontaneous modification of nonpitched aspects of sound. This is more effable with the presence of a tape, to help guide the performer though the form of the music.

EDM AESTHETICS

In understanding what is at the core of electronic music performance practices, you need to discover and assess the principles and aesthetics of electronic music. The key to understanding music of the twentieth century and particularly electronic music, Neill argues, is rhythm. The twentieth century can be seen as "The Rhythm Century" (Neill, 2002: 3) where rhythm was the engine of transformation for twentieth century music ranging from *Le Sacre du Printemps* to jazz to programmed drum beats of drum „n bass and techno. The importance of rhythm stems from the rise of minimalism in the 1960s and early 1970s, where repetitive elements were added. EDM also incorporates various elements from art music such as, experimental live performance techniques, conceptual and process oriented composition, collage performance art as well as theatre. Key to understanding the not just the aesthetics of EDM but the culture as well come from understanding the "rave" where most EDM is played. EDM can, however, in principle be listened to at any place, time or situation. The traditional roles of the performer and the audience are completely redefined at these events. The performer is just a means of social interaction and expression for the audience and is there to channel the crowd‟s energy. Herein lies an aesthetic divide in EDM; audiences want to be entertained yet they are just as important to the performance as the performer. This exists in other forms of music in that the music still exists without an audience but

music is meant to be shared with others. EDM is not necessarily focused on the artistic creation of forms but rather the technological modulations of sound. That is to say, that EDM is more concerned with matters pertaining to sound and sound production than the performer sending a kind of "creative message" to their audience.

Further aesthetic questions come to mind when dealing with electronic music. If the outcomes of electronic music are accepted as music of a different order, then concerns over the human quality of this music arise. It is argued that this order of music is „inhumane" yet the composer is responsible for nearly every aspect of that composition. The composer, "fires the machines, collects the sounds, manipulates them, pushes the buttons, programs the computer, filters the sounds...thinks of forms, and rounds up the overall structure of the piece." Linked into this misconception is the idea that it is easy to put together a piece of electronic music but there is an expert level of ability needed to understand how to compose meaningful electronic music.

CONCLUSION

Machines are an integral part of music today, be it through use in electronic music or recordings, yet the integration of the human performers into live electronic performances has been problematic. There is no performance without a human performer. This rings true on a greater societal level in modern life, the dichotomy between humans and machines. Machines are a part of every aspect of human existence yet they are „distant" from humans. In terms of live performance in EDM in the twenty-first century, humans might not necessarily be able to *perform* with machines but humans can *play* with them.

References

Appleton, J., 1999. "Reflections of a former performer of electroacoustic music". *Contemporary Music Review* 18, 3: 15-19.

Clayton, J., 2016. *Uproot: Travels in twenty-first century music and digital culture*. Farrar, Straus and Giroux: New York.

Duckworth, W., 2005. *Virtual music: How the web got wired for music*. Routledge: New York.

Dayal, G. and Ferrigno E., 2013. Electronic dance music. *Grove Music Online*. [Online]. Available: http://www.oxfordmusiconline.com/subscriber/article/grove/music/A2224259?q=electronic+dance+music&search=quick&source=omo_gmo&pos=1&_start=1#firsthit [Accessed 19th August 2013].

de la Vega, A., 1965-66. "Regarding electronic music". *Tempo, New Series* 75:2-11.

D"Escrivan, J., 2006. "To sing the body electric: Instruments and effort in the performance of electronic music". *Contemporary Music Review* 25, 1-2: 183-191. Emmerson, S., 1986. *The language of electroacoustic music*. S. Emmerson, eds. Harwood Academic Publishers: New York.

Ferreira, P.P., 2008."When sound meets movement: Performance in electronic dance music", *Leonardo Music Journal* 18: 17-20.

Holmes, T., 2002. *Electronic and experimental music*. 2nd ed. New York: Routledge.

Mumma, G. and Wolff C., 2015. Live-Electronic music. In *Cybersonic arts: Adventures in American New Music. M. Fillion*, eds. University of Illinois: 79-90.

Neill, B., 2002. "Pleasure beats: Rhythm and the aesthetics of current electronic music", *Leonardo Music Journal* 12: 3-6.

Omery, K., 2016. "Bodies and digital discontinuities: Post humanism, fractals, and popular music in the digital age", *Science Fiction Studies* 43, 1: 104-122.

Ostertag, B., 2002. "Human bodies, computer music", *Leonardo Music Journal* 12: 11-14.

Ribas, L., Performativity as a perspective on sound-image relations and audiovisuality. In: *Mono #2 cochlear poetics: Writings on music and sound arts*. M. Carvalhais and P. Tudela, eds. Research Institute of Art, Design and Society (i2ADS): 29-52.

Ross, A., 2007. *The rest is noise: listening to the twentieth century*. Farrar, Straus and Giroux: New York. Wands, B., 2006. *Art of the digital age*. Thames and Hudson: London.

Bate, M., 2007. *What the Future Sounded Like*. [Online]. Available: https://www.youtube.com/watch?v=8KkW8Ul7Q1I [Accessed 6th December 2017].

Lee, L., 1998. *Modulations*. [Online]. Available: https://www.youtube.com/watch?v=rRKuJ-r-F-A [Accessed 15th July 2017].

Martin-Delpierre, H., 2015. *Daft Punk Unchained*. [Online].Available: https://www.youtube.com/watch?v=nZjhcir9FXo [Accessed 21st August 2017].

Daft Punk, 2007. *Alive 2007 (Television/Around the World) Live performance from Denver, USA*. [Online]. Available:

https://www.youtube.com/watch?v=kMygMF93PT4 [Accessed 7th December 2017].

Menzies, Roarke, 2016. *Live at Sunningvale "Corporeal" Album Release Event*. [Online]. Available: https://www.youtube.com/watch?v=ZPP7eKFI0sw [Accessed 28th November 2017].

Zinovieff, P., 2014. *Computer Orchestra – Partita for Unattended Computer (1967)*. [Online]. Available: https://www.youtube.com/watch?v=gw-8lyZROIo [Accessed 6th December 2017].

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A Cognitive Vernacular for the Internet of Things?

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Abstract

As the spread of engineer culture is embossed upon the minds of those increasingly ordering and interacting with their lives and that of the lives of others (for the current zeitgeist of technology is to mediate and interpose in rather than directly enable communication between people) the world is walking to the beat of a new drum of cognitive hegemony.

Just as there is a vernacular in architecture, an awareness of the value of difference, locality and diversity in our shaping of our physical world. This paper proposes I that we can look to a future we would like, that we may prefer, that we may want to have the option to choose for our future environments. That we can conceive of a vernacular for the interaction design of the future of smart objects.

Keywords

Internet of things, vernacular, design, user experience, culture, interaction design, Human Computer Interaction, Conceptual modelling

Introduction

Vernacular:

NOUN: Usually '*the vernacular*'. The language or dialect spoken by the ordinary people in a particular country or region.

Informal with adjective or noun modifier: The terminology used by people belonging to a specified group or engaging in a specialized activity.

Mass noun: Architecture concerned with domestic and functional rather than public or monumental buildings.

ADJECTIVE (of language): Spoken as one's mother tongue; not learned or imposed as a second language.

Oxford English Dictionary,

As the broad autism spectrum and neo liberal capital focus of the rarified atmosphere of the valley remakes the new normal it also trains and transforms the processes, views, thinking and basic ontology of the minds that engage with, and are engaged by a cognitively monocultural landscape of interaction design. I mean interaction as that space inside a computer system that without shape, form, rules, structure or patina. That space where any suitably cognisant person can engage in what I would call *'abstract space engineering*'. That pursuit of shaping mind palaces and 'users conceptual models' to help people get things done, to communicate things to and with them, to facilitate the mental gymnastics of interacting with a nonmechanical machine.

As we are trained and remade by the view of this narrow focus of world view I think it reasonable to ask, and subsequently propose a new view.

Just as there is a vernacular in architecture, an awareness of the value of difference, locality and diversity in our shaping of our physical world. As Dunne Notes (1999 pg 137-138) technology often conspires to isolate us from the extant world with its uniformity rather than engaging with the vernacular of our location. Of the celebration of equivalent difference, of culture and identity shaped in, of, by and with the physical and mental architectural environments we inhabit so I propose that we can look to a future we would like, that we may prefer, that we may want to have the option to choose for our future environments.

As the discussion of smart city, city as process, as distributed system, as service nodes for a future connected environment grows. And as we look to the forward rolling internet of things, whatever we think it to be, it is becoming increasingly apparent that the specifics of any individual piece of hardware is less and less relevant and the notion of the internet of things as distributed services is more and more important. As these distributed services become entwined and entrenched in the version of our future environments I think it is time to ask.

Can we find, see, recognise, build or describe a cognitive vernacular for the internet of things?

As William Gibson says.

"We can't see our culture very well, because we see with it"

but if we are to avoid the monoculture of the carbon copy, cookie cutter high streets and soul-less architecture of ourof-town shopping sheds that was the, thankfully now abandoned, legacy of 1990s rural and suburban decimation the we might actually look to a future we might want. Generated from our own homes, our own distinct towns, cities communities and countries. Rather than one designed for none of us but rather than for the convenience of serving all of us, as one.

Can we imagine a future where our legacy, ageing, smart cities gain UNESCO protected status as a world heritage system?

What might the alternative be? We as scientists, researchers, designers, engineers can use observation and reverse engineer the present to make reasoned and informed assumptions of the future.

We will trade in our smart cities and smart homes for newer models that do the same in slightly different less effective ways every 12-18 months. Without realising fully that we no longer own them, we are merely provided a limited license to access them, on terms we don't understand. Where algorithms with biased reasoning work on biased data to create not just the much vaunted 2000's digital divide but a real physical divide. Depriving some inhabitants of equal access to buildings, of areas of a city, of access to types of transport, healthcare, education, services, food, heat, light, power, or water?

We understand the Rittel and Weber (1973) argument on the wicked problem and its challenges for design, (Buchannan 1992), we brought the problem from city planning and social sciences into HCI. Perhaps we should hear loud the message that single, straight, linear solutions rarely exist to situations with people in them. That design is generative and that there are often may, equivalent appropriate, but diverse, answers to a question.

A vernacular for the internet of things?

A UNESCO world heritage smart city?

What's so wrong in that vision of a possible future?

Acknowledgements

With the inspiration of Dr. Frank Nack and Dr. Kristina Andersen.

References

Buchanan, R., 1992. Wicked Problems in Design Thinking. *Design Issues*, 8(2), pp.5–21. Available at: http://www.jstor.org/stable/1511637.

Dunne, A., 1999. *Hertzian Tales. Electronic Products, Aesthetic Experience, and Critical Design*,

Gibson, William. Interview, Medium.com Hand and Brain, 2015 https://medium.com/hand-brain/william-gibson-57e75f87e525

Oxford English Dictionary, Oxford University Press, https://en.oxforddictionaries.com/definition/vernacular

Rittel, H.W.J. & Webber, M.M., 1973. Dilemmas in a General Theory of Planning. Policy Sciences, (4), pp.155–169.

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BLANK experimental interactive media art work is intimately bound in time, temporality and lens based visualization. BLANK constructs and uses experimental cameras and data visualization systems for urban imaging, street photography and visualisation.

BLANK publishes and presents widely and BLANK work has been shown at international exhibitions, galleries and conferences including; Digital Futures with Victoria and Albert Museum, London. Computer Art Congress, Paris. International Symposium of Electronic Art (ISEA) Colombia. DataAesthetics at ACM MultiMedia, Amsterdam. SIGCHI Montreal, GENART XX, Italy and Carbon Silicon at Oriel Sycharth Gallery.

Genomix Mask: Examining the complex relationship between Genes, Epoch, and Aesthetics

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Abstract

Genomix Mask is the collection of masks fabricated by a collaboration between AI and the authors. It intends to tell four ages of the world: Anthropocene, Capitalocene, Plantationocene, and Chthulucene. In the beginning, people can use technological power to extract resources and wellbeing from the world. However, over extraction and exploitation emerged and negative consequences existed. Therefore, Donna Haraway proposed us to make kin with nature. Authors interpret "making kin" by infusing DNA of humankind and animals (i.e. iguana, monitor, virus, and octopus) as a representative of nature. Ironically, to reconcile between human and nature, we need help from an 'Artificial' Intelligent (AI). To some extent, it says that it is an un-thought of ours. How AI contributes to this work? It learns heat-map of DNA and styles of animal organism and then generates many infused patterns that we can use to recompose as a mask.

Keywords

Genes, Epoch, Genome, Aesthetics, Anthropocene

Introduction

This exhibition deliberates on the interplaying between technologies, nature and humankind. Since the Anthropocene emerged, human reached to technology that can control major parts of geography and society were separated from nature. Mental model that we are not a part of natural things makes possibility to exploit them as commodities. After a capitalism was established, capital and its accumulation was a center of world-system. It was not just the economic relationships, but also the way of organizing nature and our daily life (Moore, 2016: 6).

To put is simple, capital accumulation creates prosperity at expense of human (i.e. labor and small capitalist) as well as nature. Particularly, the latter case is really damaged by its own characteristics. First, it cannot express in term of 'real' price. To be sure, there is a market price of nature; however, it might not include real value of things. The value of them for other fabricated living things or even plants in this world. Second, nature had high tolerance. Alas! Its patient has limitation. Beyond some threshold, it might strike back. Global warming and other catastrophes are strong signals of this theme.

Therefore, alternative voices are needed. Donna Haraway called for a making kin with nature (Haraway, 2015: 161). For her, bringing human back to be a part of nature are necessity, but it surely is not a smooth pathway. We must face monstrous reactions during this becoming epoch – Chthulucene. Whether we agree or disagree with this proposal, the urgency of environmental crisis and alienated roles of human from nature are inevitable.

But, how to make kin with nature scientifically? One way to think about this issue is practical infusing "our" DNA with animals and plants. However, it is ethically and legally wrong (or at least too much controversial). Therefore, in this paper exhibition, we will just computationally infuse human's genes with natural things. Then, we will use various patterns of visualized results as the artistic materials to
create the mask, so called "Genomix Mask."

We will use this Genomix Mask to illustrate this path to dystopia (from Anthroocene to Capitalocene) and some proposal for saving the humankind (Chthulucene). The mask is important feature because it usually closely covers our face and perspectives; however, we do not recognize it and could not see its details. If we deliberately look into the mask, we intended to represent warning signs into it. We hope that people can get the message and evolve for our survivals.Word Processing Software As detailed below, ISEA has prepared and made available a Microsoft Word template for use in formatting your paper. If you are using some other word processing software, please follow the format instructions given below and ensure that your final paper looks as much like this sample as possible.

Methodology

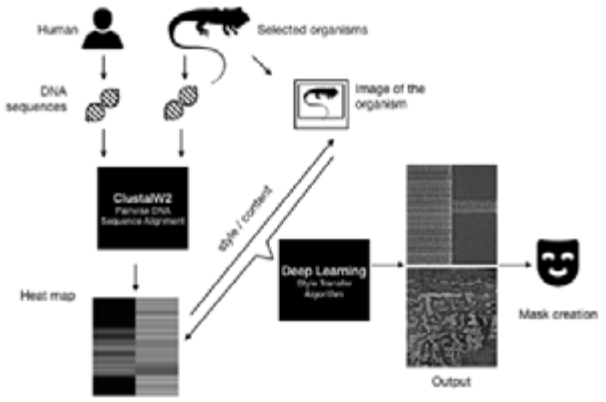

Figure 1: T*echnical outline of the Genomix project consists of three major steps : data collection, sequence*

To illustrate connections between human-in-nature and nature-in-human, across these periodization: Anthropocene, Capitalocene, Plantationocene, and Chthulucene, we infuse many DNA from different organisms alongside with human's DNA to create the masks. The process of transforming DNA into art piece starting with using ClustalW2 DNA sequence alignment algorithm to compare nucleotides (A, T, C, G) from human DNA and DNA from other species. The similarity between two distinct DNA is used to generate a heat map visualization that show the similarity and distinction between two distinct DNA. We then stylize the visualization using deep learning style transfer algorithm (Gatys: 2015) to transfer the texture from the picture of the selected organisms on their DNA and vice versa. The deep learning network was pre-trained on VGG-16 model with 16-19 weight layers and 3×3 filters in all convolutional layers. The weight content / weight style is optimized to 8.5, 3.0 and the algorithm was performing 30 iterations. After the stylization, the visualization was used as visual elements for the artist to put to assemble the masks.In addition to the masks, second skin layers were created made from stretch textiles embedded with haptic feedback, that corresponds to the wearers thoughts This process is bio-inspired by the transcription process in living cells. On the philosophical level, our process depicts our motivation to supersede ourselves into the masks that we create. On the other hand, like a mask, they superficially cover us. This contradiction is not a problem per se. Actually, incompatible between human and nature is really realistic and unavoidable.

Interpretation

Anthropocence refers to an epoch that humankind had capability enough to exploit and control geological nature. Coal mining and steaming machines, for instance, were signifiers of geological controls. Competition to utilize nature existed both in capitalism and communism camps; therefore, we use genes of people in England (where industrial revolution and practical capitalism took place) and Soviet (where communism is a part of its ideologies) as a representation.

Figure 2: *Anthropocene mask, which created from mixing England and Soviet people together*

Plantationocene is a subcategory of the capitalocene. It refers to a system of plantation or plant-production system. Labors generally are controlled by standard task, paces of machines, and incentive payment. We are all chained by the designed system. Foreign investment flows hugely after 1990s when the world economic system was unified, Soviet Union collapsed, and China engaged to be a member of the World Trade Organization. These investments came with, again, system of exploitation both on local labors and

natures. To some extent, it is a modern colonialism and slavery if it is not a primitive one. To reflect this situation, we use an african genes as a metaphor of repressive system.

Figure 3: *Plantationocene mask, which created by infusing genes of African people, cotton (Gossypium hirsutum mitogen-activated protein kinase (MAPK)), and clove (Syzygium aromaticum maturase K (matK) gene, partial cds; chloroplast)*

In Capitalocence mask (**Figure 4**), authors interpret that capital accumulation is not just an intermediary process, but it is a telos of a capitalism. During this period, capitalists emerged as a class and ones who have no capital are transformed to be a proletariat. Their labor power is alienated from themselves and sell as a fictitious commodity. Simultaneously, natural things and animals have no voices and subjectivity even if they are also exploited heavily. It inevitably leads us to negative consequences including natural disasters. To illustrate these falses, we choose three mutant animals as metaphors. Mutated iguana usually links to a strike back of nature in Japanese movie, Godzilla. Secondly, Varanus is often used as a synonym of badness in the Thai language. Finally, Eagle is a proxy of freedom, strong, and honorable. But, mutant eagle reverses these meanings. These distorted animals are still warning us silently from nowhere. As you can see, it is the deathful mask. People are left behind the iron wings and repressed by the black spear-like shape.

Figure 4: *Capitalocence mask, which created from infusing of Iguana, Varanus, Aquila chrysaetos, and human gene from their mitochondrion*

To heal and handle with unfavorable consequences of capitalocene, Donna Haraway proposed us to make kin with nature. Under this process of making kin, we need a patient which can be seen as a sickness and tolerate at the same time. There is no pleasure and easy pathways. We will face many cruel and fearful challenges like monstrous tentacles, therefore, we use genes of virus (invisible strike back of the nature) and octopus. The result existed in the **figure 5**.

Figure 5: Chthulucene *mask, wich created from infusing HIV virus, Zilka Virus, Ebola Virus, Octopus, and Human Gene*

Conclusion

Humankind used to be a part of the nature. But we continuously separated and finally ended up with overexploited it. This practice soon or later makes negative consequences to our destiny. Therefore, some scholars propose to reconcile and to remember as the nature. Transforming and infusing DNA of animals with human is allegory of this proposal. Furthermore, our work tries to experiment visualized techniques and develop them more and more, aesthetically and technologically.

References

1. Gatys, Leon A., Alexander S. Ecker, and Matthias Bethge. "A neural algorithm of artistic style." arXiv preprint arXiv:1508.06576 (2015).

2. Haraway, Donna. "Anthropocene, Capitalocene, Plantationocene, Chthulucene: Making Kin." Environmental Humanities. N.p., 01 Jan. (1970).

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Pat Pataranutaporn is a creative biologist, designer, coder and a student from Thailand at Arizona State University. He is enthusiastic in prototyping impossible things as he presented in his TED X talk “Prototyping the Impossible”. His works examine the symbiotic relationships between human and technology beyond traditional contexts ranging from using AI to cope with mental health issues on social media, designing how human interact with DNA computer, and making bioinspired device that capture proteins from insects and convert them into 3D printed food.

Bank Ngamarunchot is a lecturer of KMUTT, Thailand. He is an Economist who works in many fields such as Political Economy and Public Policy. His recent works relate to negative consequences of capitalism such as monopoly, externality, labor exploitation, and inequality. He is also an owner of the art gallery (Tentacles) located in his hometown, Bangkok.

Galina Mihaleva grew up with a passion for fashion and art; she studied costume design at Arizona State University and the Arts School in Sofia with a Master of Art degree specializing in fashion and textiles. Her interest in fashion lies in exploring the extent to which we experience fashion and how we might be able to accomplish a higher state of connectivity between the body and our clothing. Her art has been shown in festivals, galleries and museums across United States, Asia, Central and South America and Europe. In 2007 she was nominated for the best design award at Cooper- Hewitt Design Museum.

Animating Glass: Stencil Animation and Smart Materials

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Keywords

Smart Materials; Sculpture; Animation; Media Archaeology; Urban Signature; Low Energy; Light Pollution; Stencil

Abstract

Iconic urban neon has been replaced by the sign of our times, the LED screen, with increased light pollution, wasted energy, environmental damage and stress on the populace. Smart Glass is electronic film switchable between transparent and white. Safe, low voltage and highly durable, it's one of the emerging class of reactive materials becoming more commercially available yet relatively unexplored for creative potential.

Smart materials are binary, switchable and often contiguous. These properties align with the first design tool, the stencil, which has revealed potential in nearly every new media from cave drawings to nanotechnology. In Art History, the brush and chisel get all the glory but the lowly stencil preceded both.

Combining the switchable capabilities of Smart Glass with stencils laser cut into frames of animation, a moving image can traverse through physical space, inverting the paradigm of current technologies which present 3D images on 2D surfaces.

The paper will present media-archeological approaches to reveal low-energy dimensional signature alternatives to benefit urban environments by exploring ambient, low-energy display that's more integrated, sustainable and less visually invasive. Poetically, an animated stencil is sequenced light in physical form, like our vanished neon.

Introduction

Reactive Materials have increased in both number and availability but their usage focusses primarily on the environmental benefits. This paper will begin with an overview of reactive materials and how their formal properties can be matched to a design tool that is also binary and contiguous. The stencil has founded creative technologies including painting, 3D design, print, illustration, photography, cinema, computers, copy machines and now nanotechnology. Its rich utility now aligns well with smart materials. Structurally binary, stencils are made of bridges and gaps, a circuit.

As a demonstration of this media-archaeological approach to emerging materials, a prototype design as shown in Figure 1 will be presented that demonstrates how one of these materials, Smart Glass, when coupled with stencil design, can create a new form of dimensional animation. The model inverts the current paradigm of 3D images onto 2D surfaces by creating a flat image that animates through space. This first effort suggests a merging of material and tool that may allow streets, parks or districts to opt for ambient, low-energy signage to offer wayfinding and advertising solutions that are more elegantly part of the designed environment, less aggressive in intensity, and still retain the ability to present information and beauty clearly.

Figure 1. *Animating Glass Prototype 1*, 2018, Artist Name, smart glass and stencil animation, © Artist

Reactive Materials and Behaviors

Smart materials are designed to react to changes in the environment. Reagent categories include electrical, magnetic, optical, thermal, mechanical and chemical. Mediated material behaviors are becoming possible through the use of shape memory alloys, polymers, and dielectrics. Color changes are achievable through dozens of chromic reactive possibilities. While they are indeed binary, on/off, it is their transition of behavioral flux that separates them from digital simulations. [1] These materials are rarely considered for media and their reactive power is harnessed primarily for internal computer electronics and novelty items. [2]

The dynamic effects possible within these materials are pre-digital yet gaining impetus in our evolving post-digital society. MIT's Neri Oxman has begun exploring their architectural applications, enthusiastic about how these behaviors affect the design process, which she refers to as 'Design by Immaculate Conception.' Rather than sourcing materials in service of pre-established plans, the design concept emerges from interactions among matter, energy and force. "Clearly, the question of how to convert and implement some of these ideas in the context of what is today termed responsive environments appears to be a promising and challenging path for the future." [3] Following this thread, certain smart materials when controlled or sequenced may develop into a media itself. By allowing material behavior to be the foundation, the process allows for multiple design trajectories and applications.

Working with a new material inverts the usual design process: the research begins by determining the possibilities inherent in the material, not a pre-conceived final form. As such, the process becomes founded in potentialities. Foregrounding material behaviors in reactive materials is an innovative starting point that will articulate new processes of creative making.

Smart Glass

Smart Glass is a switchable electronic film often used for privacy screens. When on, it is completely transparent, when off, completely white. The material is safe and cool to the touch, shatterproof, extremely low voltage, and long lasting (the original sheet created 30 years ago is still functioning). Like many of the others in the developing class of smart materials, it is becoming more commercially available yet continues to be nearly uncultivated for its creative potential.

Part of this material's appeal is related to the built environment, already a world of glass. However, architectural glass is often obstructed by attached electronic displays that are oddly disjunctive from their hosting objects. Architecture is beginning to explore performance glazes that give glass new powers. The growth industry now rising promises dynamic glasses that are more energy efficient and suggest new aesthetics and displays. [4]

Smart Glass can be laser cut into patterns while still passing enough current to transform from clear to white as visible in Figure 2. However, the cut image must be contiguous; every part must link back to the edges and source of power. The only image possible is a *stencil.*

Figure 2. *Animating Glass Prototype 2*, 2018, Artist Name, smart glass and stencil animation, © Artist

The Lowly Stencil

Stencils are both literally and formally primitive. 35,000 years ago, early man placed his hand on the cold cave walls and then blew a stream of pigment from his mouth through a hollow bone around his fingers. [5] This creative action occurred nearly simultaneously in both Asia and Europe and within a couple centuries, elsewhere around the world. [6] On opposite ends of the planet, the first artists, indeed the first creative acts, all reached for the same tool. [7]

When the Chinese invented paper in 105AD, they quickly saw the commercial opportunities connected with stencil printing. Across six dynasties (221AD-618AD) stencils were used to mass produce images of Buddha and were key to the imagery in the Dunhuang Caves. [8] The Edo period of Japan perfected the art, making delicate stencils, called Katagami, with human hair and threads of silk. Their craftsmanship represents one peak in the history of the design tool enough to be designated as one of the Important Intangible Cultural Properties of Japan. [9] The technique travelled the Silk Road to Europe and in the Middle Ages, stenciling was partnered with woodcuts to create religious illustrated manuscripts. [10]

Miraculously, it never fell into disuse. Even in the 20th Century, stencils became halftones in the comic book industry, illustrations in design books, pochoir in the Art Deco period, moveable type signage for the military and serigraphy for mass-produced commercial fabrics. A number of key 20th Century painters embraced the medium including Warhol, Lichtenstein, Picasso, Miro, Paolozzi, Riley and Matisse. [11] Using the stencil in an urban design context is already present as the weapon of choice for today's leading urban graffiti artists.

The stencil also played a key role in Media Archaeology when used to pass light instead of color. The entire theoretical and formal history of the moving image began with stencils. Plato's Cave metaphorically and wayang kulits literally both used stencils for character and

movement. It was the basis of shadow plays and phantasmagoria that led to early cinema and the foundation of both the first photographs and first projected images. It even proved its utility further as punch cards initiated the computer industry and mimeographs the copy industry; both stencils. Looking to the future, stencils are now also used in nanotechnology. Nano stencils are incredibly thin shadow masks that allow material to be pressed onto a substrate and the only tool possible to view this newly discovered world. [13] Once again, when faced with a new media, practitioners turn to the stencil.

Shared Binary Properties

Today the electronic screen is celebrated for its enabling of complex images, both in detail and illusionary depth. This image complexity has extended to animation which has evolved into a medium that can be immersive, trans-dimensional and responsive due inherently to advances in display technologies. The simple, binary silhouettes of early animation rarely surface anymore and usually only within the context of quaint historical artefacts. The moving image seems to have moved past the stencil.

However, the nascent structures of these stencils were necessary steps towards the expansion of the moving image. At each inceptive moment, they were the only image possible on an emerging media. They formed the first images on every machine but also served as the first steps in demonstrating potential. Languages are established quickly in visual culture.

The stencil's wide utility lies in its core property which synchronizes with smart materials effectively. A web of gap and obstruction, the image itself is a circuit, purely binary. New materials are also binary, on/off switches, only triggered by electricity, temperature flux, vibration, magnetic force, or one of an array of external forces. The stencil has been our gateway to potential in nearly every emerging technology, perhaps now too it can offer direction for our new smart materials.

Spatial Exploration of Animated Images

To demonstrate this pairing of media-archaeological tool and emerging material, a prototype has been designed that explores stencil animation. Combining the switchable capabilities of Smart Glass with stencils laser cut into frames of animation, a moving image can traverse through physical space inverting the paradigm of most current technologies (VR, stereoscopy) which present 3D images on 2D surfaces.

It is unlikely that the screen and the projector are the last stops on the trajectory of the moving image. While true dimensionality is being explored by several research projects in holography and projection mapping, 3-dimensional Virtual Reality is poised to be the next commercial breakthrough. VR, like augmented reality and stereoscopic cinema, presents 3D images on a 2D surface. The prototype inverts this paradigm. Smart Glass' transparency allows for interior frames to be visible. When sequential stencils are computationally switched through spatially-distributed frames, an animated 2D image will travel 3D space as shown in Figure 3**.**

Figure 3. *Animating Glass Prototype 3*, 2018, Artist Name, smart glass and stencil animation, © Artist

By using sequenced stencils and electronically sequenced glass, the flat frame is extended into space and depth. The moving image and its frame move forward together. The effect will be a new type of animation, dimensional without glasses, spatial yet still flat. In addition, the animation created is inherent in the sculptures' materiality, not a separate system of display or projection. Because of this, the images revealed serve a dual purpose of proscenium art and abstraction of the materials' own narrative.

A city's iconic neon signs were also spatially animated forms, playing moving images through a series of tubes being illuminated. Creating their movement through sequenced light, they were old-school electric gifs. Formally, there is an elegiac thread in the prototype in which the progression of lit glass will again provide movement in a physical form. Poetically, an animated stencil is sequenced light in physical form, like our vanished neon.

Media Archaeology and Expanded Cinema also provide context for the creative potential. Early tools are once again providing insight, partially due to a resurgence in emphasizing the physical world. As leading media archaeologist and scholar Erkki Huhtamo writes, "There seems to be a parallel between the emergence of the archaeological art and some changes taking place in the cultural and intellectual ambience. The general framework seems to be the gradual displacement of the 1980's postmodernist discourse in favor of an approach which once again seeks foothold in 'real space and time'." [13]

Conclusion

Display advertising is a USD $540 billion industry, now greater than print [14] and expected to double within 5 years. [15] If this is extended beyond advertising to include electronic displays of news, wayfinding, public service and entertainment, the impact on urban environments is profound. LEDs may be difficult or even impossible to dethrone, but more options could reduce their omnipresence.

Opportunities to symbiotically articulate the uses of new materials into innovative products are rare but important if we are to make the leap from design that simply augments urban space to ideas that integrate and evolve. [16] Instead of attached screens hung externally, a subset of urban display could be structurally assimilated into its environment, inviting more visually aesthetic applications in art, architecture, park design, automotive, fashion and others. Smart Glass can offer alternatives for billboards, commercial signs, public transportation, way-finding, data visualization and other design applications.

While the creative potential of this new material is exciting, it also uses less energy, gives less pollutant, is longer lasting, and safer for public interaction. The signage provides not only more ecologically responsible solutions, but by using these materials in both content and form for creative display reminds the public in a direct, recognizable way the possibilities being explored that improve urban life with minimal harm to the environment.

Acknowledgements

The work described in this paper was fully supported by a grant from the Research Grants Council of the Hong Kong Special Administrative Region, China [Project No. CityU16274416 Reactive Media Display]

References

1. A. Ritter, *Smart Materials in Architecture, Interior Architecture and Design* (Basel: Birkhäuser, 2006).

2. M. Addington & D. Schodek, *Smart Materials and Technologies in Architecture* (Architectural Press, 2004).

3. N. Oxman, "Material-based Design Computation," Thesis submitted to the Department of Architecture, Massachusetts Institute of Technology, p. 302 (2010).

4. R. Trivedi, *Materials in Art and Technology* (Ames, Iowa: Knowlton (1998).

5. P. Ghosh, "Cave paintings change ideas about the origin of art". *BBC News* (2014). Retrieved 7 October 2017 from http://www.bbc.com/news/science-environment-29415716

6. J. Marchant, "A Journey to the Oldest Cave Paintings in the World," *Smithsonian Magazine* (2016). Retrieved 7 October 2017 from "http://www.smithsonianmag.com/history/journey-oldest-cave-paintings-world-180957685/?no-ist

7. A. Pike, D. Hoffmann, M. García-Diaz, P.B. Pettitt, J. Alcolea, R. De Balbín, C. González-Sainz, C. de las Heras, J.A. Lasheras, R. Montes, J. Zilhão, J. "U-Series Dating of Paleolithic Art in 11 Caves in Spain". *Science Magazine* (2012). Retrieved 7 October 2017 from http://science.sciencemag.org/content/336/6087/1409

8. L. Lee, "Cave Temples of Dunhuang: Buddhist Art on China's Silk Road". *The Wall Street Journal* (2016). Retrieved 7 October 2017 at https://www.wsj.com/articles/cave-temples-of-dunhuang-buddhist-art-on-chinas-silk-road-review-1467753531

9. The Agency for Cultural Affairs, "Intangible Cultural Heritage in Japan (pdf)" (2011). Retrieved 7 October 2017 from https://web.archive.org/web/20110524022138/http://www.bunka.go.jp/bunkazai/pamphlet/pdf/pamphlet_en_05

10. H. Mayor, *Prints and People*, (Princeton: Metropolitan Museum of Art, 1971).

11. Encyclopedia Britannica, "Stenciling" (Undated). Retrieved 7 October 2017 from https://www.britannica.com/art/stenciling

12. J. Brugger, "Stencil Lithography," Microsystems Laboratory (Undated). Retrieved 7 October 2017 from http://lmis1.epfl.ch/page-34708-en.html

13. E. Huhtamo, "Resurrecting the Technological Past: An Introduction to the Archeology of Media Art" (1995). Retrieved 7 October 2017 from http://www.ntticc.or.jp/pub/ic_mag/ic014/huhtamo/huhtamo_e.html

14. M. Sebastian, "Markets to Boost Global Ad Spending This Year to $540 Billion", *Advertising Age*, (March 24, 2015). Retrieved October 7, 2017 from http://adage.com/article/media/marketers-boost-global-ad-spending-540-billion/297737/

15. R. Ho, "A Bright Future for Outdoor Displays," Dow Corning Marketing (2015). Retrieved 21 October, 2015 from http://www.ecnmag.com/article/2015/02/bright-future-outdoor-displays

16. M. Taylor, "Surface Consciousness," *Architectural Design* (London: John Wiley and Sons, 2003).

Bibliography

Bratton, B. (2016). On Speculative Design. *DIS Magazine*. http://dismagazine.com/discussion/81971/on-speculative-design-benjamin-h-bratton

Brett, G. (2000). The Century of Kinesthesia. In S. Cotter and C. Douglas (Ed.), *Force fields: Phases of the kinetic* (pp. 9-68). Barcelona: Museu d'Art Contemporani de Barcelona.

Cheung, C-F. (2013). "Light pollution in Hong Kong 'worst on the planet'". *South China Morning Post*. Published March 2013,

http://www.scmp.com/news/hong-kong/article/1194996/light-pollution-hong-kong-worst-planet?page=all

Dillenburger, B. & Hansmeyer, M. (2013) The Resolution of Architecture in the Digital Age. In *Global Design and Local Materialization*, Springer, pp. 347-357

Hessels, S., Klein, T. (2016). "Skunkworks: An Educational Framework for the Mediation of Reactions". Published in the proceedings of SIGGRAPH Asia.
Hessels, S. (2012). "Sustainable Cinema: The Moving Image and the Forces of Nature" *Biologically-Inspired Computing for the Arts: Scientific Data through Graphics* (ed. A. Ursyn) IGI Global (pp. 90-104).

Hessels, S. (2017). "Lenticular Waterwheels: Simultaneous Kinetic and Embedded Animation" Leonardo Journal of International Society for the Arts, Sciences and Technology, Vol. 50, No. 4, pp. 394–399, 2017

M+ Museum Hong Kong (2015). "Neonsigns.hk" http://www.neonsigns.hk/?lang=en

Open Walls Gallery (2017). "A Brief History of Stencil Art—Quick, Simple and Explosive" https://openwallsgallery.com/what-is-a-stencil/

Quaranta, D. (2011). "The Postmedia Perspective," *Rhizome Organization*. http://rhizome.org/editorial/2011/jan/12/the-postmedia-perspective/

Speculation and Speculative Research Workshop. (2014). *Statement*. [online] Goldsmiths University of London. http://www.gold.ac.uk/unit-of-play/research/speculation/

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Scott Hessels (b. 1958) is an American filmmaker, sculptor and media artist based in Hong Kong. His artworks span different media including film, video, online, music, broadcast, print, kinetic sculpture, and performance. His films have shown internationally and his new media installations have been presented in museum exhibitions focusing on technology as well as those presenting fine arts. His recognitions include patents for developed technologies, references in books and periodicals on new media art, and coverage in cultural media like *Wired* and *Discover*. He is currently an associate professor at The School of Creative Media in City University of Hong Kong and executive producer of the Extreme Environments Program which organizes art/science expeditions to environmentally significant sites.

Turbidity Paintings: Communicating Science Through the Lens of Art

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Abstract

The project "Turbidity Paintings," proposes a new visualization methodology to record images and collect data on water quality. The core of this is to develop a system of image collection using do-it-yourself technology. Collected information is being used to construct a library of time explicit images encoded with data metrics from a variety of domestic and international locations. "Turbidity Paintings" explores and challenges the divide between the arts and the sciences and directly questions the role of the artist when dealing with science and scientific data. Art and science are not so vastly different in their approaches. The role of the artist and the art in this project is to create an experimental model by which to develop new ways to create a dialogue around, in our example, water quality.

Keywords

Data Visualization, Transdisciplinary, Interdisciplinary, Environment, Water Quality, Science and Art, Steam, Design, Research, Science Communication, Turbidity

Introduction

The project "Turbidity Paintings" proposes a new visualization methodology to record images and collect data on water quality. Information gathered in the field is being used to construct a library of time-specific images encoded with data metrics from a variety of locations, both domestic and international. The project initially experimented with using submersible remote operated vehicles (ROVs) that would be equipped with specialty tools for data collection. It has evolved to the use of a rig setup. The artists capture images in order to map the turbidity or clarity of the water.

The project seeks to create data that simultaneously exist as both an aesthetic work and as useful data of its own accord. The images and the data collected are displayed as unaltered artworks. The data and images are being analyzed to determine trends and differences in water bodies in terms of water quality. In this manner, the project seeks to provide the unassailable truth of scientifically collected data without alteration, at the same time present the data in a way that engages and produces an emotive response in a lay audience.

The legibility of the images as pure data is not the only function of the project. The experimental project process seeks to create a dialogue between the sciences and the arts by bringing together a trans-disciplinary team of artists and scientists to collaborate and discuss. This notion is not a new one, but is increasingly relevant with the growing divide between the general public and the sciences. In fact, the concept of bringing the arts into the sciences provided the focus for an article in the New York Times titled "Are Artists the New Interpreter's of Scientific Innovation?" published in 2017. The problems of the future will require teams of critical and creative thinkers tackling these problems from different angles. More importantly, the opportunity to practice in the use of a hybrid language (or Creole) will help develop the idea of working on projects using experimental processes with teams of wide-ranging expertise. Indeed, a scientist collaborating on the team has been able to use the images generated in this project for to provide data for her research, thus illustrating the ability to create images that exist as both art and data.

The Need for Art Engaging Science

Communication of environmental science research presents a problem of abstraction by where 'one cannot see the forest for the data.' One can see the results of this complex issue in the considerable amount of controversy about human impact on the environment/climate filling news headlines. Commentary from international figures, from religious to presidential, publicly taking positions on crucial environmental data has become highly politicized. Due to this phenomenon, it is increasingly important to create work that engages and creates dialogues with and around these topics.

"Turbidity Paintings" is attempting to create a result that is both art and data. This is a direct challenge to the more traditional role of the artist when dealing with science, as someone who visualizes existing data for mass consumption to the public. While visualizing data gathered by scientists provides a very valuable service, this relegates artist to the role of the translator as opposed to co-equal collaborator and thereby diminishes the potential contribution of the artist. The objective of our inquiry is a real collaboration. In a sense, this project seeks a chimeric blending of art and science to create a more intertwined discipline by combining the DNA of each.

The call for a dialogue between the Arts and Sciences is not new. The most famous of these appeals for breaking down the perceived barriers between them is the 1959 lecture by C.P. Snow, "The Two Cultures." Snow observed that two languages, one of the sciences and one of the arts, were becoming increasingly dogmatic: untranslatable and unrelatable. He was deeply troubled that he saw little interest or ability in discussion across the aisle at the University of Cambridge. Sixty-five years later, his eerily prescient warnings closely reflect the siloed disciplines of academia and research today. Indeed, there has remained a deep polar divide across many aspects of human culture for the past six decades. Equally, Snow's essay is a watershed moment marking the start of a very early interest in interdisciplinary work.

Using Snow's appeal for a dialogue between the "Two Cultures" provides the first step of true collaboration. This project's inquiry seeks to go beyond an interdisciplinary methodology (the role of the translator mentioned earlier) to create a "transdisciplinary"

framework. The term "transdisciplinary" suggests a deeper engagement than the more commonly used term interdisciplinary.

To frame the term transdisciplinary as distinct, one can look to biology and the idea of mutualism. Mutualism is a "relationship existing between two organisms of different species which contribute mutually to each other's well-being." Commonly known as a symbiosis in the biological sciences, the idea has extended to the complementary dependencies in social systems. This operative function is expressed in the etymology of the prefix trans-.

While this points to experimentation and inquiry, explicitly, interdisciplinary is an attempt (whether successful or not) to form a bridge. Inter- also suggests the idea of being between domains, but notably outside. Trans- allows for passage into another discipline. The use of prefix trans- denotes a journey into the opposite domain. Latin preposition trans- [denotes] 'across, to or on the farther side of, beyond, over',[1] thus a constructive space, reframed by the overlay or admixture of new ideas. The subtleties suggest a direct interaction versus a negotiation. Metaphorically, interdisciplinary is the doorway, negotiation table, meeting, while transdisciplinary is the condition of interdependence, reliance. The two sides need each other to be entirely successful.

The lack of an interdisciplinary language may be a symptom that helps explains why many a lopsided collaboration takes place. In these interdisciplinary collaborations, the artist is often not an equal player in the collaborative efforts. Interdisciplinary resides implicitly as a connecting, but an exclusionary space, alien to the disciplinary frameworks which it sits "between, among, amid" fields of inquiry.

Our methodologies are based on science and the arts; we use all of this to capitalize on similar processes and to create a recombinant framework. To evoke yet one more biological metaphor: these mixtures are used to create a disciplinary offspring with characteristics of both progenitors.

Art As An Experiment

Art and science are both at their core experimental in nature. However, their end goals are often different. In science, the experiment is often intended to test a scientist's hypothesis. However, the experiment is sometimes also simply trying to determine something new. Occasionally they even come up with an aesthetic outcome simply by accident. Art, while not trying to answer a question or prove a hypothesis, is seeking to discover something new through media experiments and trials and errors. Both art and science are attempting to uncover the natural world through their different, though similar, methodologies.

The question thus becomes whether it was possible to develop a visual methodology that would result in a

piece that could reside in both the art world and the science world? Is it possible to create a piece that would not only result in an aesthetic work, but also provide valuable data on water quality? The process to obtain this data has been incredibly experimental, and essentially requires attempting the development o a new method of gathering and visualizing turbidity data with new do-it-yourself, or DIY, equipment. The development of the equipment has been an evolving experiment.

In 2015, the idea was proposed for Turbidity Paintings to be an image-oriented investigation of water quality. The aim was to focus primarily on turbidity, or the clarity of the water. Turbidity, as a specific metric, was an obvious candidate for various reasons including that it is regularly measured visually in the marine and environmental sciences using the Secchi disk. The Secchi disk is dropped into the water, and a measurement is taken at the point where the disk disappears under the water. Although this method is not purely an aesthetic practice, the procedure struck us as deeply intertwined with issues of perception and visual communication.

Aesthetics in the sciences is not a primary focus of research. It is often a byproduct. Many images have come out of research that one can view as "aesthetic or beautiful." While this might be the case, the goals for obtaining images or objects was to better understand, explore or explain a system. Therefore, this project explores the idea of creating scientific objects with this aesthetic awareness from the initial stages.

The second reason for choosing turbidity was that it is often an indicator of other problems in the water; turbidity is one of the many metrics monitored by water districts. Causes of turbidity can include suspended particles brought into the water by erosion or runoff and biological organisms (algal blooms), just to name a few. In the past year, there has been significant public awareness about issues that correlate to turbidity due to news coverage of environmental algal catastrophes in Florida and California. It is feared that these blooms will become more prevalent in the coming years thanks in part to the rapid changes in climate.

Figure 1. OpenROV at the University of West Florida Aquatics Center.

The original proposal was to use the OpenRov, an open source submersible that was designed as a modifiable kit project by a team in Oakland CA. This remotely operated vehicle (ROV) submersible is a spinoff of both the open source hardware movement and idealistic development in consumer drones. One key feature of the OpenRov as a platform is that the base model includes an HD camera. The base model also has undesignated ports to allow for the addition of sensors for customization.

The technology has been enthusiastically embraced as part of citizen science technologies because of the relatively low cost, and because it was developed through the open source community, it is easily modifiable. A large international community regularly helps test new developments and publishes directions on modifications to the platform and peripherals.

The intent was to be able to use the OpenROV to obtain images at various distances, with the result being a grid of images showing what we hoped would be relative turbidity within the water column. Along with the images that would be obtained, the goal was to be able to gather additional data using sensors added to the OpenROV. Examples of other types of data that would

be gathered include dissolved oxygen, temperature, Nitrite, among others. These would then be encoded into the label for each image. The idea for "encoding" the title with the data is a nod to On Kawara's methods of titling his work in the "Today" series. These images would create a database that existed as both usable data as well as an art object. The fact that it could be read as data is very important. This importance goes back to the fundamental idea that art could exist in both realms, and that a scientist could look at the images and make a deduction about the water quality based on the data presented in the work.

While the images need to exist as data, they must also be viewable as art. "Turbidity Paintings," makes references to the 20th Century artists who worked within the procedural art movements such as Conceptual Art and Art & Language. The intent of the project leans heavily on rule-based systems as found in Ono's Grapefruit or Brecht's event scores:

1. submerge backdrop
2. take a photo of water against background at 4, 3, 2, and 1 foot
3. other data used as title (see example of chart and concatenation of metrics below)

Parameter	Results
Dissolved oxygen	51.5%
Dissolved Oxygen	3.66 mg/L
Salinity	25.8 ppt
Specific Conductivity (Corrected for Temperature)	40.32 mS
Specific Conductivity	39.55 mS
Temperature	24.0 C
NH3 [endif]	0.47 mg/L
PO4	0.15 mg/L
NO3	0.00 mg/L

30.353476, -87.038614, 51.5%, 3.66mg/L, 25.8ppt, 39.55mS, 24.0C, 0.47mg/L, 0.15mg/L, 0.0mg/L

Figure 2. Example of data obtained from field.

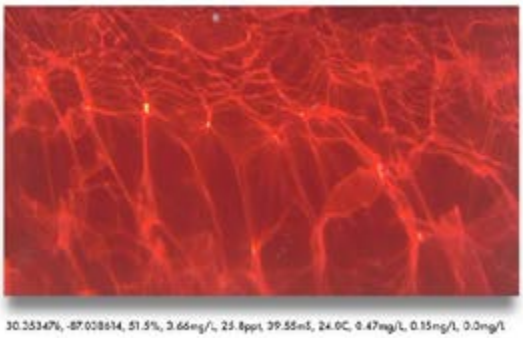

Figure 3. Example of image taken from rig using red backdrop, including data title.

Distinguishing the aesthetic goals of the work is necessary. The images collected are of the water column, not nature photography of the ocean floor or the sea life below. Despite the locations of the production, the methodology will adhere to assessable and repeatable procedure in deference to the references as mentioned earlier and the tenets of sound experimental design.

Transdisciplinary in Action

The project is not only conceptually hybrid but intentionally requires a "transdisciplinary" team. The project would not be possible without all the disciplines coming together to work on it. During the early preproduction of the work science experts were consulted that led to the assembly of a multifaceted team of student assistants and colleagues from digital art, engineering, biology, environmental science and marine studies.

The opportunity to explore the transdisciplinary practice with the student production and research assistants was pivotal. The project has also become multi-regional, though, for logistical reasons, it is currently focused in Pensacola. The usefulness of being in multiple locations hinges on the idea that the project will prove that it can draw useful data from multiple different water sources. The issues that are problems for an ocean are going to be different than the issues facing a river or lake.

Once the ROVS were ready for deployment, they were taken out to the water. The ROVs were first taken to a controlled environment. The location chosen for the maiden voyage was the Aquatics center at the University of West Florida. Here, the ROVs were launched, and the team was (both figuratively and literally) able to get their feet wet in learning how to operate the OpenROV. There has been quite the learning curve with this project. As the project is forging new terrain, there was no pre-existing manual to be followed, except for the all-important instructions from OpenROV that stated what to do in case water floods the main compartment of the submersible. Some of the first things that became apparent were the critical necessity of that having a team on hand. The difficulty of driving the sub (though the extent of this problem did not become apparent until taking the ROV to a body of water that had more of a current), and the very necessity of developing a checklist or manual for "preflight," during and "postflight."

While much of the checklist has been developed, the technology has proven to be challenging. The focus has therefore shifted from whether we can use the OpenROV to get useful photographs, to whether the whole premise of obtaining photos that result in both an art piece and usable data is possible. In order to test this further, a more rudimentary rig was developed using primarily PVC pipe and a GoPro for the camera. (Figure 4)

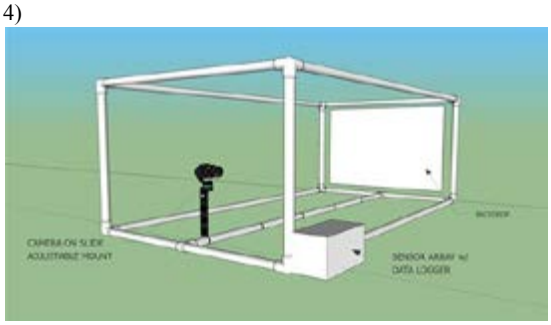

Figure 4. Mock up of rig.

Figure 5. Rig being taken out.

Since June 2016 the team has been making trips to lakes and beaches around the Pensacola area to develop the methodology and gather images. These trips have

allowed for the start of the collection process of the data and images. Early results are culminating in a range of images that are both aesthetically interesting as art objects and do seem to display a certain amount about the relative clarity of the water.

The preliminary data obtained with the GoPro has been encouraging enough to procure funding for a new higher resolution DSLR camera and underwater housing setup to replace the GoPro for the rig. Higher quality images have therefore resulted, bringing to light the formations of gradations in color fields not previously observed. (Figure 7)

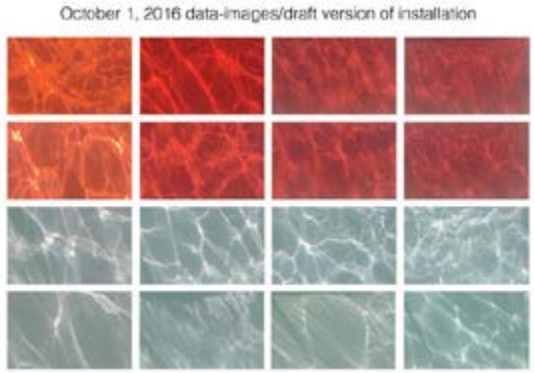

Figure 6. Mock up of grid layout of images gathered. Images gathered from GoPro

Figure 7. Samples of images obtained with DSLR camera setup on October 13, 2017

Initial Results

The collaboration between artist and scientist has so far led to multiple trips out, collections of thousands of images, and data sets to go with the images. Furthermore, the connection with the scientist has opened up for the possible investigation into analyzing the images directly. The scientist the team is working with, Lisa Waidner studies a particular type of bacteria that uses both photosynthesis and anaerobic metabolism. She was able to analyze the images to determine whether there was bacteria in the water. Due in part to this collaboration, the images can exist beyond art objects.

The images that resulted from the project were able to validate the research that Lisa Waidner was already doing, and therefore the collaboration was beneficial to her research. This sort of validation in the sciences is called "ground truth," where information is being gathered by observation. This ability for the artist and the scientist to collaborate and work together to create an outcome where the research is strengthened demonstrates that a true partnership between the disciplines can create a constructive dialogue.

Furthermore, the data being obtained alongside the images, when viewed with the images, is resulting in trends to become visible. (Figure 8)

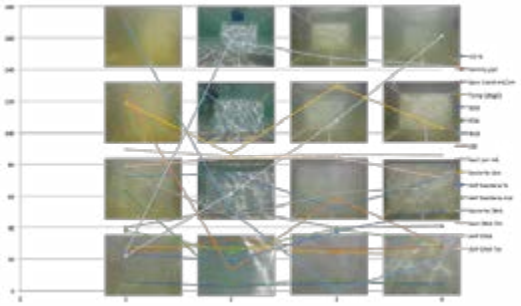

Figure 8. Grid of images and corresponding data aligned. Y-axis is distance from backdrop; X-axis is date of image collection.

Conclusion

A true collaboration between artists and scientists can create a valuable dialogue and outcomes for both parties. As this project is demonstrating, the dialogue between a marine scientist and an artist has resulted in usable data and art images, and data that helped field validate the data the scientist was already collecting. Furthermore, the need for these collaborations between artists and scientists is only going to increase in importance. As recognized by the recent article in the New York Times mentioned earlier, it is becoming increasingly important to have artists working with scientists, beyond the role of simply visualization of the science. They must also be asking the questions along with the scientists of the implications of the research being presented.

References

[1] Trans-, prefix [Def. 1]. (n.d.). In In Oxford English dictionary online. Retrieved November 30, 2016, from http://www.oed.com.ezproxy.lib.uwf.edu/view/Entry/204
575

Bibliography

Inter-, prefix [Def. 1a]. (n.d.). In Oxford English dictionary online. Retrieved November 30, 2016, from http://www.oed.com.ezproxy.lib.uwf.edu/view/Entry/97516

@. (n.d.). OpenROV | Underwater Exploration Robots. Retrieved November 30, 2016, from http://www.openrov.com/

Ono, Y. (1964). Grapefruit. Tokyo: Wunternaum Press.

Snow, C. P., & Collini, S. (1998). The two cultures. New York: Cambridge University Press.

Trans-, prefix [Def. 1]. (n.d.). In In Oxford English dictionary online. Retrieved November 30, 2016, from http://www.oed.com.ezproxy.lib.uwf.edu/view/Entry/204
575

Williams, Gisela. "Are Artists the New Interpreters of Scientific Innovation?" The New York Times Style

Magazine. 12 Sept 2017 Published. The New York Times Web. 8 Jan 2018.

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Online Social Network based on Internet of Things and Habit of Drinking Coffee in South of Brazil

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Abstract

We describe an Internet of Things-IoT system composed by a thermos flask with embedded sensors and network interface as result of art and technoscience experimental research. The system can connect to the internet after activity recognition and send a message over an online social network (e.g. Twitter/ Facebook) when hot coffee is made. The idea is to create a connected device that can engage people to interact face-to-face bringing old habits of drink coffee as an excuse to socialize. Drink coffee with friends is a habit spread globally; in the south of Brazil, the tradition to cultivate and drink coffee is strong present especially in elderly people. The prototype is being improved before users' tests, opening new perspectives to the concept of "online social network based on IoT".

Keywords

Internet of Things, online social network, thermos flask, coffee.

Introduction

Elderly people (but not limited to) in Brazil usually invite friends to drink coffee in their houses as an excuse to socialize. Also, in some regions of the country, the coffee plantation and consumption defined the cultural and economic growth (Camolezi & Costa, 2009)

Historically, in Parana state, located in the south of the country, a climate event called "geada negra" (black frost) in 1975 made the producers lost a considerable amount of the coffee. This event forced the government to encourage another agricultural culture but a recent resumption of coffee production by public agencies (including tourism) have the intention to reinforce the tradition and bring new opportunities to farmers with new biotechnological strategies to control and defend the production (Rafaelli, 2004).

The multicultural history of cities like Maringá and the tradition of produce and consume coffee present in the imagination of the population pushed us to think about an IoT (Internet of Things) device to integrate the consuming and cultural habit to drink coffee as a social and historical event. As a combination of a physical object with the networks, the IoT promises new opportunities to art and science, by embedding into it a computer and the communication power (Greengard, 2015). The IoT potential is applied to any sorts of daily objects and this experimental art and technoscience paper describes the creation of a prototype, a thermos flask with embedded sensors and network interface. The system can connect to the internet after activity recognition and the device can send a message over an online social network (e.g. Twitter/ Facebook) when hot coffee fills the object inviting friends to drink in their house. The idea is to create a connected device that can engage people to interact face-to-face bringing old habits of drink coffee as an excuse to socialize.

Coffee green gold times

The restart of coffee tradition in the region, with another type of seed, a specialized one called "gourmet", brings the opportunity to reinforce the place that was the main producer of the most part of coffee consumed in Brazil ("A nova cafeicultura do Paraná," 2014). Many industries are now installed (such as "Companhia Cacique de café Solúvel" and "Iguaçu Café" among others and commerce associated) producing all sorts of coffee and tourist tours are also suggested to plantation fields. Educational institutions contribute with the cultural background preserving and sharing the tradition, UniCesumar, a private educational centre in Maringá, has a museum with a coffee barn– an old wooden house from 1949 transferred integrally to campus with scenography of old coffee times.

In terms of coffee consumption habits Trancoso, Cavalli & Proença (2010) indicate the strong presence of coffee in Brazil, putting the country as the second global coffee consumer (ABIC-Associação Brasileira de Indústria de Café, 2015), especially during breakfasts, taking account its stimulation potential, a perfect drink to start the day (Fredholm, Bättig, Holmén, Nehlig, & Zvartau, 1999).

The habit of drink coffee reserves also a cultural aspect and capacity to integrate and reunite people (Arruda et al., 2009). In public, private and familiar environments or during studies and work times it is common to create small break moments to interact with others. In Brazil, the ex-

pression “hora do cafezinho” (“time to a little coffee”) is common in private and public sector, when workers stop their activities to talk and drink coffee. With the aim to reinforce this social, communicational potential and cultural aspect of drinking coffee we designed an IoT system to stimulate interaction between users mediated by coffee shared times.

Online Social Network based on IoT

The idea of IoT is to decentralize the computation-device power to small and connected devices. These ordinary objects when smartly connected with each other can add their computation capacity and synchronously work to “improve” our daily life. This tendency was announced before by Mark Weiser (1991) when he talked about ubiquitous computing and confirmed now with the invasion of smart devices “everyware” (Greenfield, 2006). The prevision is that in 2020, the IoT “which excludes PCs, tablets and smartphones, will grow to 26 billion units” (Rivera & Van der Muelen, 2013). Many factors contribute to this increasing number of connected objects including the size, price and computational power of electronic components, communication protocols and design principles (McEwen & Cassimally, 2014).

This trend seems irrevocable when we saw all sorts of connected objects connected that opening new affordances (Gibson, 1966) and contexts of interaction (Dourish, 2004). Artists, designers and engineers with many examples and working in collaboration are given just some highlights that how we can use and embodied our experiences with the enchanted objects. From our imagination, all sorts of objects can work together to support us (like cups and wardrobes in Disney’s “The Beast and Beauty”) but also for surveillance and control (van Kranenburg & Bassi, 2012). Now, we have integrated landscape of objects with sensors, microprocessors, middleware and software that work in the periphery of our attention (Weiser, 1996). Some examples are washing machines that can tweet when finished work (Milian, 2009), a plant that tweets when it needs water (Faludi, 2011), chairs that vibrates when you received an email (McEwen & Cassimally, 2014) and other healthcare applications (Hsu, Wang, Shen, Chiang, & Wen, 2017).

These enchanted objects blurry the taxonomical division of people (alive) and objects (inert). The tendency confirms that cyberspace has been clued to the physical objects opening new fronts of works called pervasive and sentient (Rheingold, 2003).

From many possibilities and scenarios, we are devoted to thinking about how IoT can integrate people. We know that IoT can help people in everyday activities, including people with disabilities (Domingo, 2012) and elderly population (Pal, Funilkul, Charoenkitkarn, & Kanthamanon, 2018) but how can we stimulate social interaction and improve cultural tradition being naturally attached to habits and the history of the place? This perspective of using connected devices to support interaction has been receiving the name of “Social Internet of Thing” (Atzori, Iera, Morabito, & Nitti, 2012) but in this paper we prefer to call this as “online social network based on IoT” or OSNIoT (Lucena, Oberleitner, Barbosa, & Martins, 2017). Researchers have been challenged to create a smart architecture to integrate all sorts of objects, including in the context of social interaction (Kranz, Roalter, & Michahelles, 2010; Nitti, Atzori, & Cvijikj, 2014).

Methods - Designing and test the “thermos flask”

The device is built using an LM35 (temperature small sensor) inserted into a commercial “thermos flask” (fig.1), a microprocessor and controller Arduino Uno R3, energy fonts of 5 volts e GND. A communication module “Ethernet Shield” is responsible to connect the system to the Internet (especially to Twitter). The sensor is responsible for sensing the temperature and when it hits the temperature = or > 80ºC the system sends a single tweet. It is noticeable that coffee is made with hot and boiled water. As a first version, a LED was installed to give a feedback when communication was made.

After the single tweet message: “come to my home to drink a coffee with me” the system block another message over 8 hours (average time to another coffee make). The IoT device received the name of “coffeezin” that in Portuguese sounds like “little coffee”.

Fig. 1 –sensor LM35 sensor embedded inside the container of the flask. (Right): prototype with Arduino UNO R3 and Ethernet Shield module attached using a nylon body band. Photos: authors.

Also, a social experiment was applied during two subsequent weeks. A user, living in a condominium with 352 apartments, majorly with undergrad students, posted on Facebook group page a brief explanation about the project and the number of unit that they can visit to drink the coffee as soon they see the online post.

The protocol adopted to make coffee were; 1) from 7:30 am until 9 am, and 2) 4:30 pm to 6 pm every day from 7 to 20 May 2017.

Results and comments

After two weeks we counted two (2) unknown neighbours (1 after 30 minutes of the post – another after 44 minutes of the original post) and 1 frequently seen neighbour (after 36 minutes). One comment in the post showed that another neighbour went to the house but didn't find the user, when asked about the time she said that were around 11 am. Small interviews were applied to know about their habit to drink coffee and drink preferences (filtered or capsules). All of them live alone (not share the apartment) and they are a student.

We interact daily with many objects, in many places and context. The kitchen is, for example, a place in the house where manually operated devices/objects are constantly, and where new technologies are well accepted. This integration of technology in the kitchen is a natural movement, especially in the field of domotics and experimental works as cited by Spence & Piqueras-Fiszman (2013).

Optioning to create a thermos flask we take the environment into consideration. A kitchen is a place where we can understand and historicize different aspects of cultures (Bryson, 2011) and with symbolic dimension. Previous examples of IoT devices designed to the kitchen environment offers, majorly, facilities. There is coffee machine, refrigerator and microwaves activated at distance or by proximity. Meaningful and sometimes not so meaningful things are created to take our world as imaginative and creative forms of IoT. "Pantelligent" ("Pantelligent," n.d.), is a frying pan developed with the temperate sensor and Bluetooth communication module to guide/help a "chef" to cook better. It integrates a smartphone with a special app with some recipes. "HAPIfork" is a fork that counts the time that you spend during meals and how many times you take it to your mouth and the gap between chews ("hapifork," n.d.). "Pred Pad" is a balance scale to measure the weight of the food and show in real time some nutritional data displayed on smartphone ("Pred Pad," n.d.). Another idea tries to promote smart objects with online social networks, Whirlpool Co, for example; a cooker with an interactive touchscreen cooktop displays recipes, Facebook/Twitter updates, and news and climate condition. And at least, "Smart Fridge" can smartly see the products inside the Fridge, helping the user to identify when the food is getting old (Itzkovitch, 2013).

Other devices, when used in a drink relation were designed to bar environments, objects like a cup can be transformed in a "social sensor" (sensor of social activity) (Beigl, Gellersen, & Schmidt, 2001). And in a similar perspective, researchers created a beer mat to entertainment to use in bar and pubs. The object has a pressure, gravity, orientation and movement sensors to measure the weight of the cup and infer about social interaction and activity (Butz & Schmitz, 2005). By interacting with these devices, we can infer about group meetings and time spending on kitchen or bar.

We went in another direction, as an ordinary object that is not the centre of attention (thermos flask) we used to comprehend more about the activities and infer about social interaction.

Conclusion and further developments

All data from the device can be used to identify a pattern of coffee consumption, time of production and even the replies and comments can signalize acceptation to social and in locus visit. Designing challenges can include: a) as augmented and ordinary thermos flask with sensors, the system cannot change the basic functionality of the device to keep the temperature. Our first intervention a small hole made on top of the object can accelerate the losing of temperature; b) designing solutions are needed also to create a robustness object to support interaction such as the cleaning and washing process of the thermos or even falling; c) create smart solutions to identify when user did a small quantity of coffee for individual consumption or when is opened to received friends and familiar, and d) smartly integrate the system to friends/family that are really going to visit, identifying potentially friends to visit the user based on: historical background interaction, frequency of interaction and location. At least, smart solutions of software, sleep mode or counting time can contribute to the autonomy and lifecycle of batteries.

For now, we are combining the thermos flask with an air freshener. Considering the smell of coffee as good marker/stimulus to wake up, a hacked automatic air freshener emits the coffee fragrance in the friend's house when the coffee is made and inserted in the thermos. All ideas take social and interactional background as inspirational material to design IoT system.

References

A nova cafeicultura do Paraná. (2014). Retrieved December 1, 2015, from http://www.rotadocafe.tur.br/norte-do-parana.html

ABIC-Associação Brasileira de Indústria de Café. (2015). Indicadores da industria de café no Brasil - 2015. Retrieved May 13, 2016, from http://www.abic.com.br/publique/cgi/cgilua.exe/sys/start.htm?sid=61#tabconsint2015.2

Arruda, A. C., Paula, V., Minim, R., Aurélio, M., Ferreira, M., Minim, L. A., … Soares, C. F. (2009). Justificativas e motivações do consumo e não consumo de café. *Ciência E Tecnologia de Alimentos*, *29*(4), 754–763. http://doi.org/10.1590/S0101-20612009000400009

Atzori, L., Iera, A., Morabito, G., & Nitti, M. (2012). The Social Internet of Things (SIoT) – When social networks meet the Internet of Things: Concept, architecture and network characterization. *Computer Networks*, *56*(16), 3594–3608. http://doi.org/10.1016/j.comnet.2012.07.010

Beigl, M., Gellersen, H.-W., & Schmidt, A. (2001). Mediacups: experience with design and use of

computer-augmented everyday artefacts. *Computer Networks*, *35*(4), 401–409. http://doi.org/10.1016/S1389-1286(00)00180-8

Bryson, B. (2011). *At Home: A Short History of Private Life*. Norwell-MA: Anchor.

Butz, A., & Schmitz, M. (2005). Design and Applications of a Beer Mat for Pub Interaction. *Proceedings of the Seventh International Conference on Ubiquitous Computing (UbiComp'05)*, 2–4.

Camolezi, B. A., & Costa, J. M. (2009). A substituição de culturas e a dinâmica populacional no norte paranaense entre 1930-2005. *Actas Del XII Encuentro de Geógrafos de América Latina*, 1–13.

Domingo, M. C. (2012). An overview of the Internet of Things for people with disabilities. *Journal of Network and Computer Applications*, *35*(2), 584–596. http://doi.org/10.1016/j.jnca.2011.10.015

Dourish, P. (2004). *Where the Action is: the foundations of embodied interaction*. Cambridge-MA: MIT Press.

Faludi, R. (2011). *Building Wireless Sensor Networks*. *MWRF Article*. Retrieved from http://www.rfdh.com/ez/system/db/lib_jnl/upload/3521/1129454260/[MWRF0509]_Building_Wireless_Sensor_Networks.pdf

Fredholm, B. B., Bättig, K., Holmén, J., Nehlig, a, & Zvartau, E. E. (1999). Actions of caffeine in the brain with special reference to factors that contribute to its widespread use. *Pharmacological Reviews*, *51*(1), 83–133. http://doi.org/0031-6997/99/5101-0083$03.00/0

Gibson, J. J. (1966). *The Senses Considered as Perceptual Systems*. Boston, MA: Houghton Mifflin Harcourt.

Greenfield, A. (2006). *Everyware: the dawning age of ubiquitous computing*. (E. © 2006 Peachpit Imprensa Berkeley, CA, Ed.) (3st ed.). New York City: New Riders Publishing.

Greengard, S. (2015). *The Internet of Things*. Cambridge-MA: MIT Press.

hapifork. (n.d.). Retrieved December 14, 2015, from https://www.hapi.com/product/hapifork

Hsu, C. C.-H., Wang, M. Y.-C., Shen, H. C. H., Chiang, R. H.-C., & Wen, C. H. P. (2017). FallCare+: An IoT surveillance system for fall detection. In *2017 International Conference on Applied System Innovation (ICASI)* (pp. 921–922). IEEE. http://doi.org/10.1109/ICASI.2017.7988590

Itzkovitch, A. (2013). The Internet of Things and the Mythical Smart Fridge. Retrieved December 13, 2015, from https://uxmag.com/articles/the-internet-of-things-and-the-mythical-smart-fridge

Kranz, M., Roalter, L., & Michahelles, F. (2010). Things that twitter: social networks and the internet of things. *In What Can the Internet of Things Do for the Citizen (CIoT) Workshop at The Eighth International Conference on Pervasive Computing (Pervasive 2010).*, 1–10. Retrieved from https://vmi.lmt.ei.tum.de/publications/2010/ThingsThatTwitter_preprint.pdf

Lucena, T. F. R., Oberleitner, V., Barbosa, M. D., & Martins, H. V. P. (2017). Augmenting Object with IoT to Enhance Elders' Social Life. In K. Giokas, L. Bokor, & F. Hopfgartner (Eds.), *eHealth 360°* (pp. 36–41). Budapest: Springer. http://doi.org/10.1007/978-3-319-49655-9_6

McEwen, A., & Cassimally, H. (2014). *Designing the Internet of Things* (1 st). Chichester: John Wiley & Sons Ltd.

Milian, M. (2009). Washing machine Twitters when clothes are done. *Los Angeles Times _ Technology*, p. 1. Retrieved from http://latimesblogs.latimes.com/technology/2009/01/twitter-washing.html

Nitti, M., Atzori, L., & Cvijikj, I. P. (2014). Network navigability in the social Internet of Things. *Internet of Things (WF-IoT), 2014 IEEE World Forum on*, 405–410. http://doi.org/10.1109/WF-IoT.2014.6803200

Pal, D., Funilkul, S., Charoenkitkarn, N., & Kanthamanon, P. (2018). Internet-of-Things and Smart Homes for Elderly Healthcare: An End User Perspective. *IEEE Access*, *6*, 10483–10496. http://doi.org/10.1109/ACCESS.2018.2808472

Pantelligent. (n.d.).

Pred Pad. (n.d.). Retrieved December 13, 2015, from https://www.kickstarter.com/projects/chefsleeve/smart-food-scale-less-about-weight-more-about-you/description.

Rafaelli, D. R. (2004). *Geoprocessamento para a avaliação do impacto de geadas na região cafeeira de cornélio procópio-PR*. UNESP- Botucatu.

Rheingold, H. (2003). *Smart Mobs: The Next Social Revolution*. New York: Basic Books.

Rivera, J., & Van der Muelen, R. (2013). Gartner Says the Internet of Things Installed Base Will Grow to 26 Billion Units By 2020. *Gartner*, 26–28. Retrieved from http://www.gartner.com/newsroom/id/2636073

Spence, C., & Piqueras-Fiszman, B. (2013). Technology at the dining table. *Flavour*, *2*(1), 16. http://doi.org/10.1186/2044-7248-2-16

Trancoso, S. C., Cavalli, S. B., & Proença, R. P. da C. (2010). Café da manhã: caracterização, consumo e importância para a saúde. *Revista de Nutrição*, *23*(5), 859–869. http://doi.org/10.1590/S1415-52732010000500016

van Kranenburg, R., & Bassi, A. (2012). IoT Challenges. *Communications in Mobile Computing*, *1*(1), 9. http://doi.org/10.1186/2192-1121-1-9

Weiser, M. (1991). The Computer for the 21st Century. *Scientific American*, *265*(3), 94–104. http://doi.org/10.1038/scientificamerican0991-94

Weiser, M. (1996). Designing Calm Technology. *Nomadic 96*, 1–5. http://doi.org/10.1.1.135.9788

Digital Arts for Young Audiences?
Mediation and Dissemination of Digital Arts and Culture to Norwegian School Children

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Abstract

Through mobile and networked technologies such as the smartphone, digital technologies, environments and experiences are to an increasing extent impacting the production and presentation of everyday aesthetics. Yet, most art productions offered to young audiences are still based on methodologies and expressions that predate the digital shift. *Arts for Young Audiences Norway* is the Norwegian Ministry of Culture's agency responsible for bringing and presenting a wide variety of professional art and culture to all school pupils in Norway. In this paper, we address the important question of our children's digital rights, outlining future and needed policies for bringing digital arts and culture to children and young people, asking: How do we produce and present digital arts for young audiences?

Keywords

Digital arts for school children, young audiences, digital rights, mobile and networked technologies, dissemination of digital art

Introduction

It has become a truism that children growing up today, in an age of increasingly rapid technological shifts, face a world of social interaction and communication which is decisively different from those growing up just a decade earlier. An example of this change is the fact that 9 out of 10 Norwegian children aged 9-16 now own a smartphone [1] – a technological device that reached worldwide success only 10 years ago. Notably, in addition to calling and texting, children use their smartphones to listen to music; to make, edit and share images and films; to play games and search for information on the internet. In this way, the smartphone has become an integral part of the everyday life of most kids in Norway. It is a raster unto the world; one among several ways in which children interact with their environments and social networks; in which they form and negotiate their public identities and self-perceptions; in which they sense and create, move and play.

Using this smartphone example as point of departure, the questions addressed in this paper engage with how recent digital technologies and cultures impact on the way in which we think about *art* for young audiences. This is among the prioritized areas for the Norwegian national agency *Kulturtanken – Arts for Young Audiences Norway.* [2] When the everyday life of children and young people appears to be saturated with new ways of experiencing artistic works (such as music, images, literature or film), as well as new ways of engaging in artistic and aesthetic creation themselves, how should the arguably more traditional, pre-digital and "analogue" field of arts for young audiences respond?

Indeed, what are the prospects and challenges of using recent digital technologies in the production, distribution and reception of arts for young audiences? How can new digital technologies facilitate new modes of sensation, perception and cognition? What kind of obstacles related to physiological, psychological, technical, or ideological issues do we need to be attentive to when dealing with digital arts and culture for children and young people? What about the institutional frameworks governing the education of teachers and artists? [3] How should issues pertaining to ethics, digital privacy, big data and corporate interests be balanced against innovation, creativity and the need to be in tune with contemporary developments when the target audience is school pupils? These are some of the important questions to be addressed in our time when the Millennials – those born after the 1980s onwards and raised with digital technologies as a natural part of daily life – start to influence how art is conceived and consumed. [4]

The Cultural Schoolbag

Kulturtanken – Arts for Young Audiences Norway is the Norwegian Ministry of Culture's agency responsible for making professional art and culture available to all school pupils in Norway. Most prominently, this includes nationwide responsibility for *The Cultural Schoolbag* (TCS), which is the centrepiece of the government's policy for bringing culture to children and young people. [5] Briefly put, *The Cultural Schoolbag* secures that all children growing up in Norway have access to professional art – spanning literature, music, visual arts, performing arts, film and cultural heritage. This is done through close collaboration between *Arts for Young Audiences Norway,* county councils and municipalities, schools and cultural institutions. The program is ambitious and far reaching. Four times a

year in average, 3300 schools, including 870 000 school pupils in the country are visited by professional musicians, writers, theatre companies, dancers, artists and other cultural producers through *The Cultural Schoolbag*. The explicit political aim is to provide all children living in Norway with a shared frame of reference and joint experiences, irrespective of their nationality, address, wealth and social background. It is held that artistic and cultural expression can transcend norms, languages and social identities, and in this way, be a force for democracy that ideally can be felt far beyond our national borders, reaching out into the world.

While *Arts for Young Audiences* is an agency of the Ministry of Culture, it also works very closely with the Ministry of Education and Research, which is responsible for the institutions where TCS is implemented, namely the schools. In addition to being responsible for TCS, *Arts for Young Audiences* will provide advice and other services to the central government authorities involved in the culture and education sectors, thus helping to establish a political framework and working to improve national initiatives.

Bringing arts and culture into the framework of schools and primary education is a growing field in Scandinavia and the Baltic region. Related organizations in an international context are for example the Irish *Arts in Education* [6], the American *Young Audiences Arts for Learning* [7], and various other national programmes. The common challenge for them all is how to grapple with the emerging digital habits of children, understanding how these habits influence and transform how children and youth perceive, approach and interact with contemporary artistic and cultural forms.

Digital Arts in *The Cultural Schoolbag*

As UNICEF puts it, "digital technology is an irreversible fact of our lives". [8] The receptivity with which new media genres, platforms and formats are taken up by young people, effortlessly appropriated, applied and integrated into their lives and minds is impressive. In this situation, not to acknowledge the obvious impact of digital media on contemporary culture would be foolish, even irresponsible. Thus, *Arts for Young Audiences* is currently discussing how digital arts and culture could be included and added to the other six cultural fields covered by *The Cultural Schoolbag*. However, before we can start drafting such a scenario, there are a number of conceptual challenges to be discussed. First of all, as digital media have become an integral part of the production, distribution and reception of works within all the other genres, what would our rationale be to add "digital arts and culture" as a separate category? Perhaps "the digital" should rather be included as a dimension to be addressed within each of the other, already existing genres?

In the event that we add digital arts and culture as a separate category to the other six, it would encompass a wide range of genres, from robotics; software art; interactive literature; social media art; video games and game art; virtual, augmented and mixed reality works; computer generated music and sound art; to the educational use of digital technology, such as augmented reality (AR), in mediating cultural heritage. However, if we instead choose

Figure 1. School children wearing the Hololens system while interacting with Minecraft models.

to include the digital as a dimension within each of the six genres that are already covered in *The Cultural Schoolbag*, we must be careful not to reduce its role to be a mere mediational tool in the nationwide distribution and mediation of essentially non-digital works of art. While potentially being able to reach a wider audience, this solution runs the risk of reducing the artistic quality of the mediated work, resulting in an audience experience of a comparatively low aesthetic quality. This would be counter-productive to *Arts for Young Audiences'* primary mandate which is to enhance the artistic *and* mediational quality of *The Cultural Schoolbag*. To this end, digital media should be employed as a mediating tool only to the extent that the dimensions it adds to the artwork function to enrich or enhance, rather than reduce, the aesthetic experience of the work. This is a rather ambitious goal, but a necessary way to proceed if we are to explore the full potential of digital media in the mediation of art to young audiences.

One example of such an approach is the collaboration with the cultural heritage project *Borgarsyssel*. [9] Here, schoolchildren use *Minecraft* as a tool in building and reimagining the old Viking settlement in the Norwegian city Sarpsborg. To add to the project's disseminative quality we developed a tool to export the *Minecraft* models into the *Microsoft Hololens* display system. (Figure 1) Seeing the *Borgarsyssel* models in augmented reality extended the perceptual cues and qualities of the project by adding an immersive dimension. In our digital lab setting, this positively influenced the schoolchildren's involvement and increased their level of engagement.

A related, but different, aspect to explore in this respect is the mediation of artistic methods – of artistic practice – for example, musical composition. *Arts for Young Audiences'* predecessor *The National Touring Concerts* launched in 2015 an educational video game called *Lyderia*

[10] (translating to "*Soundia"*), in which pupils learn to compose small pieces of music as part of a challenging, yet encouraging, structure of puzzle solving. The game is available for free, and has so far been played by more than 30 000 pupils and teachers.

Finally, digital arts and culture must be present in *The Cultural Schoolbag* as aesthetic and cultural artefacts in their own right. *Arts for Young Audiences'* mandate states that the *The Cultural Schoolbag* shall interact with the schools' educational plans, meaning that it should maintain a supportive, but never subordinate, role. Experiencing art works that ponder and play with technology, providing insight into fields such as, for example, robotics, artificial intelligence, neuroscience or biology might instigate reflection, wonder and fascination in a young audience vis á vis our technological presence and future. This exemplifies how the aesthetic experience of art works may in itself inspire the children to engage in further learning, without the artists being expected to compromise their artistic autonomy in the process.

Outlook: Digital Art Futures and Framing the Digital Rights of Children

Through mobile and networked technologies such as the smartphone, digital technologies, environments and experiences are impacting both the production and presentation of everyday aesthetics. Yet, in a Scandinavian context, most art productions offered young audiences are based on methodologies and expressions that predate the digital shift. The fact that they seldom relate to the digital lives of children are possible reasons why feedback from children in schools often report artistic experiences to be irrelevant or simply 'boring'. [11] Another obstacle when it comes to the potential impact of digital technologies within a compulsory educational system is that few art teachers have experience with the creation of digital forms of art. [3]

The virtual space of online, social media is indeed a representational space, but, put in the formula of Lefebvre, also a lived and a real space. [12] Thus, the young audiences and the Millennials perceive their digital everyday life as *real*. Where others see the flickering of the screen, young audiences perceive it as an experiential reality. As Latour puts it, the more digital, the less virtual (as unreal), and the more material a given activity becomes. [13] [14].

Currently one out of three Internet users are children. [8] One could argue that in a world where digital technologies are becoming a natural everyday component and basic need, opening up to digital arts and the possibilities of interactive and co-creative experiences is becoming a question of children's rights. "The Convention on the Rights of the Child," Article 29, states that '*The education of the child shall be directed to … (a) The development of the child's personality, talents and mental and physical abilities to their fullest potential…*'. [15] Further, Article 31 states '*State parties shall respect and promote the right of the child to participate fully in cultural and artistic life and shall encourage the provision of appropriate and equal opportunities for cultural, artistic, recreational and leisure activity*.' These are powerful statements written in pre-digital times. Now, in a world marked by digital tools and an everyday online presence in Social Media (SoMe), children's access to experiences such as digital arts ought to be recognized as a most natural and self-evident element. So far, however, it is not. Thus, in a world experiencing a tsunami of cultural changes [16], initiatives and international forums such as ISEA are needed to frame and further the fundamental debate about how to make and disseminate digital arts for young audiences.

References

[1] Norwegian Media Authority. (2016). *Barn og medier 2016 (Children and Media 2016)*. http://www.barnogmedier2016.no/mediehverdagen p. 18. Downloaded 21.1.2018

[2] http://www.kulturtanken.org

[3] Filimowicz, M. & Tzankova, V.. (2017). *Teaching Computational Creativity*. Cambridge University Press.

[4] Pedró, Francesc. (2006). *THE NEW MILLENNIUM LEARNERS: Challenging our Views on ICT and Learning*. OECD-CERI. http://www.oecd.org/edu/ceri/38358359.pdf Downloaded 311.2018

[5] https://www.artsforyoungaudiences.no/

[6] http://artsineducation.ie/

[7] Young Audiences Arts for Learning, www.youngaudiences.org

[8] UNICEF. (2017). *The State of the World's Children 2017: Children in a Digital World*. https://www.unicef.org/publications/index_101992.html Downloaded 21.1.2018

[9] https://ostfoldmuseene.no/stikkord/minecraft/

[10] https://www.lyderia.no/

[11] Breivik, J.-K. & Christophersen, C. (eds.) (2013). *Den kulturelle skolesekken (The Cultural Schoolbag)*. Arts Council Norway.

[12] Lefebvre, Henri. (1991). *The Production of Space*. Blackwell.

[13] Latour, Bruno. (2011). *Networks, Societies, Spheres: Reflections of an Actor-Network*. International Journal of Communication 5 (2011), p. 796–810.

[14] Bautista, S. S. (2013). *Museums in the Digital Age: Changing Meanings of Place, Community, and Culture*. Rowman & Littlefield.

[15] UNESCO. (2006). *Road Map for Arts Education. The World Conference on Arts Education: Building Creative Capacities for the 21st Century*. http://www.unesco.org/fileadmin/multimedia/HQ/CLT/CLT/pdf/Arts_Edu_RoadMap_en.pdf Downloaded 21.1.2018

[16] Anne Bamford. (2017). *The Role of Arts in a Changing Educational Landscape*. http://artsineducation.ie/wp-content/uploads/Anne-Bamford-Essay-1.pdf Downloaded 21.1.2018

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BALANCE-UNBALANCE (E-ARTS MEETS THE ACTUAL WORLD)

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Abstract

Environmental problems, economic uncertainty and political complexity have been around for a long time. What was different before was the speed and depth of transformations compared with today's sudden changes. The frequent occurrence and severity that certain weather and climate-related events are having around us is increasing, and the ability of human beings on modifying the environment have turn into a power capable of altering the planet. How can the electronic art play a role in helping to revert the current mass destructive tendency? Can we artists make a difference, participating with our electronic art of multi- inter- or trans- disciplinary teams, in finding solutions to complex problems such as climate change? Aiming to use electronic art as a catalyst with the intent of engendering a deeper awareness and creating lasting intellectual working partnerships in solving our global environmental crisis, some initiatives (e.g. Balance-Unbalance) are in development and will be discussed during the proposed panel.

Keywords

Electronic arts, media arts, sound arts, humanitarian actions, climate change, environmental crisis.

Speakers

Among the guest speakers for this panel there will be artists, scientists, curators and engineers. At the time of this writing, some of the names proposed for the panel are:

- Pat Badani
- Nina Czegedy
- Ricardo Dal Farra
- Roger Malina
- Anne Nigten
- Mike Phillips

All the proposed artists, scientists and curators are well-known for their interest and participation in activities related to searching how to solve environmental problems.

Introduction

Environmental problems, economic uncertainty and political complexity have been around for a long time. What was different before was the speed and depth of transformations compared with today's sudden changes. The frequent occurrence and severity that certain weather and climate-related events are having around us - such as floods, twisters, etc. - is increasing, and the ability of human beings on modify-ing adjacent surroundings, as well as very distant places, have turned into a power capable of altering the whole planet.

The global climate is changing, and communities around the world are suffering the consequences. Traditional disaster management approaches are not enough to deal with rising risks, and new forms of collaboration are needed to inspire people and organizations to link knowledge with action.

Artists could inspire new explorations regarding how to actively participate in this major challenge of our environmental crisis. We need to develop innovative ways to facilitate a paradigm shift towards a sustainable future. We need to discuss proposals for the future from a diversity of cultural perspectives and socio-economic situations with open minds. Creative thinking, innovative tools, and transdisciplinary actions could help to produce perceptual, intellectual and pragmatic changes. It is not about an indulgent utopia for the future nor desire, but a matter of survival.

Aiming to use electronic art as a catalyst with the intent of engendering a deeper awareness and creating lasting intellectual working partnerships in helping to solve our environmental crisis, some initiatives have been operating for several years -such as the *Balance-Unbalance* international conference series- and it is the time to make an evaluation of their actions and outcomes, to best define the next steps.

Balance-Unbalance

The *Balance-Unbalance* project was launched with an international conference in 2010, aiming to develop the role of the media arts and artists in dealing with environmental challenges. *Balance-Unbalance* explores intersections between nature, art, science, technology and society as we are moving into an era of unprecedented ecological threats. The first conference was held in Buenos Aires, Argentina. It was organized by the Electronic Arts Research and Experimentation Centre (CEIArtE) from the National University of Tres de Febrero. Papers were delivered by a representative of the National Secretary of Environment and Sustainable Development of Argentina, experts and graduate students from different universities with chemical, agricultural and environmental engineering backgrounds (some of them specialists in pollution, renewable energies and food technologies), a lawyer, a sociologist and philosopher, artists coming from Argentina, Brazil and Canada, and an astrophysicist (Balance-Unbalance, 2010).

Balance-Unbalance (a.k.a. BunB) was held again in 2011, this time at Concordia University, in the city of

Montreal, Canada. Those were two days of reflection, debate, information exchange and promotion of projects and actions regarding the environment and our responsibility at this crucial moment in history. This conference was possible thanks to the direct involvement of faculty from Concordia University coming from very diverse backgrounds, like communication, political sciences, geography, management, music, digital arts and design. There was an amazing number of submissions received to participate in the conference with paper presentations, posters, films, electroacoustic and computer music, art installations and also a diversity of transdisciplinary sessions with open structures to accommodate all kind of innovative proposals, always considering digital art as the interconnecting hub and the environmental crisis as the umbrella covering us all (Balance-Unbalance, 2011).

Once again in 2013, a third edition of *Balance-Unbalance* was showing the high potential of these actions. The expected catalyzer started to work and the digital arts were, step-by-step, leading the way. This time the conference was held at the Noosa biosphere, an ecological reserve recognized by UNESCO in Australia. The Noosa Biosphere is a dynamic learning laboratory for sustainability in one of the most pristine and diverse environments in Australia. The three-day conference took place at Central Queensland University, with satellite events in several other places, including Lake Cootharaba (Balance-Unbalance, 2013).

An e-book with some of the papers presented at the 2013 *Balance-Unbalance* conference was published and it can be downloaded from the Internet for free (Davis, 2013).

The conference theme: 'Future Nature, Future Culture[s]' aimed to challenge our expectations of Earth, provoke our understanding of nature and inspire our actions for a sustainable future. *Balance-Unbalance* was proposing to ask ourselves: "What we will be calling nature in 20, 50 or 100 years? How we will live in the future? How could creativity help us shape a society of understanding and interconnectedness? What role could transdisciplinary thought and action play in reimaging a sustainable future?" considering that: "All is interconnected. No person, no animal, no object or idea can exist independently. Our limited knowledge of life can be expanded, but to do so we need better ways to understand each other. This includes a deeper awareness of how different human societies can comprehend cultural differences and synergies. There is a dramatic need for a paradigm shift and we need to act now if we are going to survive as a species." (from the *Balance-Unbalance* 2013 website).

Like in previous editions, digital art was not only part of the papers in the form of theoretical analysis and proposals but a substantial component of the event. A number of artistic events were also held in partnership Fifteen short papers on research and creation projects presented during this conference have been published by The MIT Press on Leonardo, the Journal of the International Society for the Arts, Sciences and Technology, on a special section devoted to *Balance-Unbalance* (Dal Farra, 2014).

The fourth edition of *Balance-Unbalance* was held in March, 2015. It was hosted by Arizona State University and its main focus was set on: "Water, Climate and Place. Reimagining Environments". The subject reflects some particularly relevant circumstances considering the location: The Southwestern desert of the United States.

Balance-Unbalance 2016 was held in Manizales, Colombia. This city is part of the coffee-grower axis and it is built in a mountain region with seismic instability. A rich, changing and challenging environment, with a subtropical highland variety of climate and an average of 1,500 millimeters (59 inches) of precipitation a year, that allowed participants to have a contrasting experience considering the places where previous editions of the conference where held (Balance-Unbalance, 2016).

Twenty-six short papers about projects presented during the Balance-Unbalance 2015 and 2016 are already available on the MIT Press website and published on paper by Leonardo (Dal Farra, 2018).

The most recent edition of *Balance-Unbalance* was hosted by Plymouth University, in the UK, during 2017 (Balance-Unbalance, 2017). Among many other activities, it included one evening at the amazing Eden Project, in Cornwall, where also a Leonardo/ISAST 50 years celebration was held (Eden Project, 2017).

'*art*! ⋈ *climate*'

Sometimes experiments take their own way, and ideas becomes real. Dr. Pablo Suarez, Associate Director of the Red Cross / Red Crescent Climate Centre came to Montreal in 2011 as a keynote speaker of the second *Balance-Unbalance*, held in 2011. As a direct result of his participation in this conference, the '*art*! ⋈ *climate*' project was born shortly after (*art*! ⋈ *climate* call, 2012).

The Red Cross / Red Crescent Climate Centre and the Electronic Arts Research and Experimentation Centre (CEIArtE) joined forces to develop the *art*! ⋈ *climate* contest for the creation of digital sound-based art miniatures focusing on the environmental crisis and climate change related issues. The Climate Centre's mission is to help address the humanitarian consequences of climate change and extreme weather events. In its efforts to engage people at risk, government agencies, academic institutions and other stakeholders, it has become clear that information is rarely sufficient to trigger behavior change. As a result, the Climate Centre is designing and facilitating methods for learning and dialogue that involve not only the brainpower but also the emotions of participants (such as collaborative workshops, participatory games and short educational films, linking information, decisions and consequences on disaster management).

The *art*! ⋈ *climate* contest had two main objectives: a) Provide the Climate Centre with sound-based art material that can support their actions; and b) Improve knowledge about the human dimensions of the environmental crisis and promote awareness about the effects of climate change, both among creative artists and among those exposed to their work.

For this contest, sound art miniatures implied short creations of sound art/music produced using new technologies and encompassing what is known as soundscapes, electroacoustic and computer compositions, sonorizations, and sonifications.

The categories of the first contest were two: 'Mosquitoes' and 'Open Theme'. The 'Mosquitoes' category aimed to support initiatives to raise awareness and better manage the growing risk of malaria, dengue and other mosquito-borne diseases that are showing new regional and seasonal patterns due to changes in rainfall and temperature - an issue highlighted in several Red Cross projects in Africa, Asia and the Americas. The 'Open Theme' category invited submissions about other dimensions of changing environmental conditions.

The works were selected by a jury of internationally recognized composers and new media artists, and members of the Climate Centre as well, finding that was possible to have good artistic works that could also fulfil the specific needs of an humanitarian organization for its daily field actions. Selected works came from sound artists and electroacoustic composers from all over the world (*art*! ⋈ *climate* selected works, 2013).

All pieces are now available in SoundCloud both for listening online and for downloading, under a Creative Commons license (*art*! ⋈ *climate* SoundCloud, 2014).

Composing digital sound art miniatures proved to be a great way for musicians to stop being spectators and start to contribute actively to humanitarian goals.

A second contest was launched in 2014. This time, several organizations were teaming up: the original two organizers, CEIArtE and the Red Cross / Red Crescent Climate Centre, now together also with the Climate and Development Knowledge Network (CDKN), the International Institute for Environment and Development (IIED), and the Overseas Development Institute (ODI) (Development & Climate Days, 2014).

There were also two categories on this second *art*! ⋈ *climate* contest. As before, the categories were defined according to the needs specified by the humanitarian organizations, that on this opportunity were: 'Sea level rise' and 'Zero poverty. Zero Emissions. Within one generation' (2nd *art*! ⋈ *climate*, 2014).

The selected pieces have been already presented in several international events, and also same as with the first edition of *art*! ⋈ *climate*, are available in SoundCloud for listening online and for downloading. The Red Cross / Red Crescent Climate Centre -and associated humanitarian organizations- are able to using them according to their field action needs.

A third contest is being held at the time of this writing. The categories once again were proposed by the Climate Centre considering the potential use of the pieces as part of their actions. The "Timescales" category is expecting to use art and music to incite an emotionally driven exploration of the difference between weather and climate, considering it can be useful to communicate the interaction of trends and extreme events. The "Thresholds" category focuses on the actions that could be implemented in the window between a forecast and a disaster, and how the triggering level can be identified and the full system explained (*art*! ⋈ *climate* call, 2017).

Panel/Roundtable

In this context of global threats: Can the electronic arts and artists help? A large part of the population is living in uncertainty [regarding basic needs] and many barely surviving. When the Balance-Unbalance project started some years ago it probably appeared to be a naïve, good-will based, utopian initiative, trying to join intelligence and forces from a variety of fields in using e-art as a catalyst to face a problem we all share: the complex environmental crisis. Bringing people from very different sectors of society together, today Balance-Unbalance and its associated projects are not only proving it is feasible to connect artistic creation and realistic tools for change but to actually help in making that social changes could happen. The electronic arts acting as a driving force. The possibility to work on a project where artistic quality, knowledge building, and humanitarian actions are all together in a balanced equation to confront the unbalance is feasible (Dal Farra, 2013).

Is enough what Balance-Unbalance, and projects like the 'art! ⋈ climate' have been doing? The idea of focusing on creation-knowledge-action projects to reach those who are already affected or in imminent danger from the consequences of climate change, and also to those who are not directly touched by it yet is in the core of these projects. What are the next steps we can give to expand the possibilities of these, and other related projects? Should we need to look for different models? How can we improve collaboration between players coming from different fields and disciplines in a way to more effectively help our society? Are these inter- and transdisciplinary experiences achieving their ultimate goal? In a world where goodwill is far from enough, how can we accelerate results to have a better life in a humanly livable planet? What are roles that artists can play working together with scientists, engineers, experts in economy, and policymakers? How ethics and responsibility should act in this complex proposal based on multiple visions and collaboration processes? These are some early triggering questions that will be refined to reach ISEA2018 in the best possible shape, to discuss between the participants of the panel, and then receive the input of everyone attending. The main idea is here to propose realistic actions that could mitigate the impact of climate change, and change the current trend, to have a cleaner environment. As electronic artists, we can work together with experts from many different fields to contribute to this process, and we want to explore and discuss with this panel, the best way of doing it.

References

Centro de Experimentación e Investigación en Artes Electrónicas, Universidad Nacional de Tres de Febrero. (2010). Equilibrio-

Desequilibrio / Balance-Unbalance 2010 International Conference. Buenos Aires, Argentina. Retrieved from http://www.ceiarteuntref.edu.ar/eq-deseq-en

Hexagram Concordia Centre for Research-Creation in Media Arts and Technologies and Music Department, Concordia University. (2011). Balance-Unbalance 2011 International Conference. Montreal, Canada. Retrieved from http://balance-unbalance2011.hexagram.ca/

Noosa Biosphere and Queensland Central University. (2013). Balance-Unbalance 2013 International Conference. Noosa, Australia. Retrieved from: http://www.balance-unba lance2013.org/

Davis, S. (Ed.). (2013). Future nature, future culture(s). Peer-reviewed papers for Balance-Unbalance 2013 International Conference, Noosa Biosphere and Queensland Central University, Australia, ISBN: 978-1-921047-73-2 (online) 415 pages. Retrieved from: http://www.balance-unbalance2013.org/program--proceedings.html

Dal Farra, R. (Ed.). (2014). Papers from the 3rd Balance-Unbalance International Conference. *Leonardo, Journal of the International Society for the Arts, Sciences and Technology*, Vol. 47, No. 4, Pages 489-514. United States: MIT Press.

Dal Farra, R. (Ed.). (2018). Papers from the 4th and 5th Balance-Unbalance International Conference. *Leonardo, Journal of the International Society for the Arts, Sciences and Technology*, Vol. 51, No. 3 and 4. United States: MIT Press.

University of Caldas, Manizales. (2016). Balance-Unbalance 2016 International Conference. Manizales, Colombia. Retrieved from http://www.balance-unbalance2016.org/

Plymouth University. (2017). Balance-Unbalance 2017 International Conference. Plymouth, UK. Retrieved from http://balance-unbalance2017.org/

Eden Project. (2017). Cornwall, UK. Retrieved from http://www.edenproject.com/

Red Cross / Red Crescent Climate Centre, and Centro de Experimentación e Investigación en Artes Electrónicas, Universidad Nacional de Tres de Febrero. (2012). *art*! ⋈ *climate / arte*! ⋈ *clima* call 2012. The Netherlands, and Argentina. Retrieved from http://www.ceiarteuntref.edu.ar/art_climate

Red Cross / Red Crescent Climate Centre, and Centro de Experimentación e Investigación en Artes Electrónicas, Universidad Nacional de Tres de Febrero. (2013). *art*! ⋈ *climate / arte*! ⋈ *clima* 2013 selected works. The Netherlands, and Argentina. Retrieved from http://www.ceiarteuntref.edu.ar/art_climate_selected_works

Red Cross / Red Crescent Climate Centre, and Centro de Experimentación e Investigación en Artes Electrónicas, Universidad Nacional de Tres de Febrero. (2014). *art*! ⋈ *climate / arte*! ⋈ *clima* 2014, SoundCloud. The Netherlands, and Argentina. Retrieved from https://soundcloud.com/ceiarte

Zero poverty. Zero emissions. Within a generation - Development & Climate Days. (2014). Lima, Peru. Retrieved from http://www.climatecentre.org/site/development-and-climate-days

Red Cross / Red Crescent Climate Centre, and Centro de Experimentación e Investigación en Artes Electrónicas, Universidad Nacional de Tres de Febrero. (2014). 2nd *art*! ⋈ *climate / arte*! ⋈ *clima* 2014. The Netherlands, and Argentina. Retrieved from http://ceiarteuntref.edu.ar/art_climate_2014

Red Cross / Red Crescent Climate Centre, and Centro de Experimentación e Investigación en Artes Electrónicas, Universidad Nacional de Tres de Febrero. (2017). *art*! ⋈ *climate / arte*! ⋈ *clima* call 2017. The Netherlands, and Argentina. Retrieved from http://www.ceiarteuntref.edu.ar/art_climate_2017

Dal Farra, R. (2013). Can the Arts Help to Save the World? *Leonardo, Journal of the International Society for the Arts, Sciences and Technology*, Vol. 46, No. 2, Page 110. United States: MIT Press. Retrieved from http://www.mitpressjournals.org/doi/abs/10.1162/LEON_e_00524

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Transdisciplinary Collaborative Practices in Art, Science and Technology

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Abstract

The present panel seeks to problematize what constitutes transdisciplinary collaborative practices in contemporaneity. We will examine their increasing emergence; their methodologies, their challenges and propositions, and what it means to work jointly and why it is important. The aims of this panel are to open discussion on facillitating creative collaboration between different areas of knowledge; on heightening social inclusion in scientific and technological development; and on stimulating pertinent collective local actions based on transdisciplinary collaborative work. We intend to discuss some practices and methodologies used on the development of an artistic board game about the city of Salvador, Brazil; to describe the alternative forms of financing culture characteristics and explore what they can contribute to fostering the cultural commons, while also pointing to possible developments and new collaborative financing forms that can evolve in the future; and to question how we can really and effectively develop innovative and useful ways to do research and apply our findings having a creative approach. Thus, we look to dialogue based on the multiplicity and diversity of expression inherent in the minor and the socially micro-political which differ from identity posturings that are polarized and proprietary and which serve the interests of totalitarian development models.

Keywords

Collaborative Practices, Transdisciplinarity, Art, Science, Technology, Community, Commons, City, Game Practice, Experimental Transdiscipline.

Introduction

Andreia Machado Oliveira e René Smith

The present panel seeks to problematize what constitutes transdisciplinary collaborative practices in contemporaneity. We will examine their increasing emergence; their methodologies, their challenges and propositions, and what it means to work jointly and why it is important. By incorporating this panel in the *Hybridisation and Purity* subtheme, we focus our concerns on the intersection of practices in art, science and technology.

In order to problematize what constitutes collaborative practices in contemporary art and its transdisciplinary engagements, we adopt a procedural and paradoxical position towards activities which embroil the collective and the singular, the global and the local, or the mental and the embodied. The positional strategies are based on the multiplicity and diversity of expression inherent in the minor and the socially micro-political which differ from identity posturings that are polarized and proprietary and which serve the interests of totalitarian development models.

We propose three issues to be considered: how do methodologies of collaborative practice come about within emergent transdisciplinary relations (often in workshops with shared projects)? how to deal with joint authorship in which the artist/scientific researcher is not the author of the conception of the work, and less of its production, but still consider themselves co-creators along with the communities involved? and how does the documentation, distribution and dissemination of collective techno-aesthetic objects happen?

Aiming to differentiate between the Common and the modern idea of society, we look to mesh with the thought of theorists Gilbert Simondon, Bruno Latour, Antonio Negri and Michael Hardt whose works articulate concepts such as the transindividual, the collective and multitude and direct them to power the Common.

The Common refers to what is not in the public or private domain, but to the dimension of what is common to many. It is not linked to party organizations or established institutions, and does not organize itself spontaneously; it requires routine practices and organizational projects specific to each community and which involve the community—in other words, the common requires the constitution of specific practices proper to each community.

We ask what is the place of art, science and technology in the construction of the Common? How does one participate in the Common, in the transmission of transdisciplinary knowledge, in the dissemination of social experience? How does one position art in terms of producing an aesthetics of plurality and not one of universality?

Thus, the aims of this panel are to open discussion on facillitating creative collaboration between different areas of knowledge; on heightening social inclusion in scientific and technological development; and on stimulating pertinent collective local actions based on transdisciplinary collaborative work. We look to dialogue on how to share processes, not products; share singularities and not identities; produce difference and not more of the same in order to activate the powers of the collective.

From this point of view, this panel looks forward to contributions that enrich the problematization the theme in different ways: on the question of siting of art, science and technology towards the production of the common, author Lenara Verle, raises highly pertinent issues in "Towards a commons financing of art & intellectual commons"; with his focus on transdisciplinary practices, professor Ricardo Dall Farra in "Experimental Transdiscipline", brings previous experiences that think the relation between art and other disciplines; and to examine methodologies of collaborative practices, Karla Brunet discusses the development of an artistic board game in Salvador/Brazil, in "Collaborative game practice and the city". The objective is to generate informed exchange, relevant discussion, and applicable insights that lead us to think together how transdisciplinary collaborative practices are occurring today and how they may be put into action.

Collaborative game practice and the city

Karla Schuch Brunet

This panel intends to discuss some practices and methodologies used on the development of an artistic board game about the city of Salvador, Brazil. Having psychogeography and the art of walking as a starting point, we have produce a collaborative artistic board game. The game is based on the experience of moving through a place, in this case, the city of Salvador, and feeling its environment. It is an art game based on environmental aesthetics, *flâneur* and experiencing the city as art, as a game. It is the *Topophilia* popularized by Yi-Fu Tuan, to appreciate the place, loving it. Unlike a mere contemplation of the place, this project aims to raise issues of mobility, urbanism, environment, aesthetics and pollution. Here we discuss collaboration in three levels, on the creation and development of the game, on its playability - it is a cooperative game – and, on its replicability, anyone can copy the game or create his/her own, we published an open source GDD (Game Design Document) on how to construct one.

First, we had an open call for people interested in developing a game. People from different backgrounds and disciplines showed up to collaborate. They were invited to brainstorm, think about their territory and decide which parts of the city were important to be in the game. Later, we made field trips to these places to collect materials / experiences. The GPS trails of these outputs helped us create the map of the game board. Project participants photographed and drawn objects they found on these paths. These have become counters of the board game. Subsequently, the objects chosen as parts were modeled and printed on a 3D printer. We have competitive-cooperative goals and the movements of a player can deprive or rewards all players. The player in this game will be able to help another player, distribute their winnings, and donate their objects and experiences in the city. Collaboration here is mandatory to win the game.

"*Descaminhar*" is the name of the game. It's about leaving one's way, being a *flâneur*, and wandering. Many board games have the concept of a path, of going in a move. A large number of them have "movement" as the main action. Considering our own geographic spaces, experimental cartography and cognitive maps, we have created the main drawing of the board. At the same time, we thought about the strategies, objectives and problems to be solved during the game, always related to the city of Salvador. The objectives can be individual or collective. And the tasks can be related to enjoying the city, solving a problem, improving the situation or creating an experience.

The game consists of board, cards (challenge, narratives, events and item description), pins, 3D counters, time marker, tokens, and the box along with the manual. The board or modules of the game consists of places of the city of Salvador that need to be unlocked throughout the match. The 3D counters symbolize the items that each player achieves during the match, and the cards guide us to the movements to be made. All the material of *Descaminhar* board game can be download. We also encourage players to create their own board game, about their city or location that interested them.

After having done some game tests in different locations – lab, university, school, and art events – we perceived that this art game is a stimulus to practice and discuss collaborative action. In the beginning of the match, the great majority does not like or understand the cooperative goals. After the match is over, their attitude has changed; they are very open to collaboration. When thinking about environment issues and global warming, art is a great method for raising questions about our place, surroundings and collaborative practices.

Towards a commons financing of art & intellectual commons

Lenara Verle

We have today an artificial scarcity imposed on digital intellectual goods by way of DRM and copyright laws. Copyright evolved historically as a response to reproduction technologies such as the printing press and the phonograph. Since those times, authors faced a balancing act. In order to make a living from the sales of their work, part of the profits should find a way back to them through royalties and copyright practices. But too tight of a control might mean the work would not get distributed widely and therefore miss the opportunity to enrich and develop the culture in its full potential (not to mention the artist him/herself). This dilemma still exists. Art and culture is a type of commons and enclosures in the form of copyright laws harm our collective heritage and our access to this cultural wealth. On the other side, artists and authors need the means to live and produce their work.

Options for alternative forms of financing culture are emerging and being tested, making use of digital and networked technologies available in the present. This panel

aims to describe their characteristics and explore what they can contribute to fostering the cultural commons, while also pointing to possible developments and new collaborative financing forms that can evolve in the future. Some of the structures reviewed are: crowdfunding (from product reward only to alternatives highlighting the creation of commons), patronage (content-based or more geared to generating monthly income), cultural funds (and their forms of curation and governance) among others.

Authors have the choice to release their works with copyleft and commons-friendly licenses, and several initiatives are working to develop and refine such licenses in the framework of current national and international law. If new forms of collaborative financing can provide both the living means for artists and allow their work to be disseminated freely, enriching the global cultural commons, that can mean an end to the dilemma and a new paradigm for the distribution and access to culture.

Experimental Transdiscipline

Ricardo Dal Farra

Life is about communication and mutual understanding or disagreements. Humans have created systems and regulations in trying to understand how this world works, but we are far from finding answers to complex issues. The traditional academic structure based on rigid disciplines has proven not to work well to face problems such as climate change or poverty, naming here only two among many multi-dimensional challenges we are facing.

Can we really and effectively develop innovative and useful ways to do research and apply our findings having a creative approach? The solution to complex problems is being explored, increasingly, from multi and interdisciplinary perspectives. However, those strategies are not enough in many cases, and therefore developing a transdisciplinary approach becomes an essential tool.

There are different definitions about multi-, inter-, cross- and transdisciplinary research. The approach of considering transdisciplinary research as a way to create a unity of intellectual frameworks looking beyond a disciplinary perspective seems to be appropriate and useful also from the arts perspective.

It took centuries to build the complex system we have today for the teaching and learning of the various fields of knowledge, as well as to support the research that has been allowing us "to advance", at least in the terms that we understand it in our Western civilization. At the same time, it is necessary to recognize the different visions that people have of the world, and even if sometimes could be hard for us to understand or accept it, some of that can teach us and can be reflected in our academic or professional activity.

Art helps us to connect with the world or to isolate ourselves, to understand and embrace or to dissent, to make sense or to confuse, it can be an engine to free our creativity or to lock it. Art is linked to politics and economy, it can convey feelings and emotions, can also lead us to think about human biology or complex mathematical equations; it can apply principles of fluid mechanics and key elements from game creation, and can open new spaces, make use of very simple or extremely complex techniques, be based on serendipity, and navigate between the accidental or casual and causal, too.

We need to learn about crossing borders again and going beyond the limits, even if some of them are strong as walls. We should be able to understand different perspectives about the world and generate knowledge from a broader apprehension of reality.

The conceptual proposal of transdisciplinarity might be interesting to some but still too far from a possible practical implementation. Some examples of activities developed considering a transdisciplinary approach follows. Activities that have been bringing art and disciplines apparently far from each other close enough to work from a unified but large conceptual framework:

(a) The Transdisciplinary Creation and Performance class offered by Concordia University in Montreal.

(b) The Transdisciplinary Workshop realized as part of the Interactive Design and Creation Master program at the University of Caldas, Manizales.

(c) The international symposia Balance-Unbalance that "bring artists together with scientists, economists, philosophers, politicians, management and policy experts, sociologists and engineers from across the world with the intent of engendering a deeper awareness and creating lasting intellectual working partnerships in solving our global environmental crisis".

Art as an engine of change, as a key element that adds and helps to build the web of life. The route of uncharted territories, where certain signs could open new paths or stop us, following our experience and desires but also according to the way we see, we listen, we act.

References

Attali, J. (1977). *Noise. The Political Economy of Music*. Translated by Brian Massumi, 1985. United States: University of Minnesota Press.

Bollier, D. & Helfrich, S. (2017, April 18). *The Wealth Of The Commons: A World Beyond Market and State*. Retrieved from http://wealthofthecommons.org/sites/default/files/the_wealth_of_the_commons.prc

Dal Farra, R. (2015). Breaking Paradigms: Electronic Arts & Humanitarian Actions. *Balance-Unbalance 2016*. Colombia. Retrieved from: http://www.balance-unbalance2016.org/docs /Dal_Farra_BunB_Breaking_Paradigms_2015.pdf

Hardt, M. & Negri, A. (2004). *Multitude:* war and democracy in the age of empire. Nova York: Penguin Press.

Latour, B. (2012). *Reagregando o Social:* uma introdução à teoria do Ator-Rede. Tradução de Gilson César Cardoso de Sousa. Salvador - Bauru: EDUFBA – EDUSC.

Kreutzer, Till. (2018, January 04). *Open Content - A Practical Guide.* Retrieved from https://meta.wikimedia.org/wiki/Open_Content_-_A_Practical_Guide_to_Using_Creative_Commons_Licences/Introduction:_From_theory_to_practice

Oliveira, A. M. (2017). Arte e Comunidade: Práticas de Colaboração Implicadas no Comum. *PÓS:Revista do Programa de Pós-graduação em Artes da EBA/UFMG*. v.7, n.14, 42-60.

Negri, A. (2009). Para uma definição ontológica da multidão. *Lugar Comum,* Porto Alegre, n. 19-20, 15-26.

Neuwirth, R. (2011). *Stealth of Nations: The Global Rise of the Informal Economy.* New York: Pantheon Books.

Simondon, G. (1964). *El individuo y su genesis Físico-Biológica – La individuación a la luz de las nociones de forma y de información***.** 1 ed. Tradução Ernesto Hernández B. Paris: Universitaires de France.

Tuan, Y. (1974). *Topophilia*: a study of environmental perception, attitudes and values. New York: Columbia University Press.

Conversation Session: Mediated Empowerment

Using Media and Technology to Amplify the Voices of Local Communities

Category: Socially engaged media art

Panel conveners: Jill Scott and Eugenio Tisselli

Speakers in presentation sequence:

- Nan Kolè from Gqom Oh! (Durban, South Africa)

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- Jill Scott from Eskin4 (Zurich, Switzerland)

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- Stefanie Wuschitz and Patricia J. Reis from Mz* Baltazar (Vienna, Austria)

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- Eugenio Tisselli from ojoVoz (Barcelona, Spain)

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ABSTRACT

How can media and technology be used to amplify the voices of local communities? Various groups are now forming to provide local communities with new media art opportunities for visibility and empowerment. These communities are micro communities or micro-cultures, often with immaterial infrastructures or unorthodox approaches. The organizers are interested in media art as a voice for autonomy and collaboration, and all focus on small scale human-centered activities that promote anti-monopoly and community orientation. Their activities aim to empower local users with hands on experience and technological understanding. They focus on curiosity and confidence through demystification and intersectional participation, indeed they value the very need to share and learn about each others differences. All all cases, the voices of the members from local communities are seldom heard and need to be recognized, celebrated and amplified.

In this panel four representatives from current media-based initiatives talk about their own deep engagement with their respective communities. They explore the relevance of these initiatives within their local and broader contexts, and focus on both the different and similar ways they engage with actors: artists, scientists, technologists and activists. They reflect on how these socially-engaged transdisciplinary collaborations may bring about empowerment and investigate the long-term potentials of the media and technologies that are put to use. Specific topics will be addressed like access, visibility, empowerment, feminism, the commons, ownership, colonialism and post-colonialism, appropriation, and reciprocity. The diverse disciplines of the communities represented in this panel – *small scale farming, street music, feminist hacking and visual impairment*–guarantee a rich discussion, backed by the depth of their theoretical approaches and the solidarity of hands-on and on-the-ground experiences for each community.

Bios and Abstracts

Nan Kolè DJ and label owner Nan Kolè is a natural-born musical activist. A long-time advocate of contemporary African music and trans-national cultural exchange and runs the label Gqom Oh!

URL: https://www.residentadvisor.net/dj/nankole

Gqom Oh!

Gqom Oh! is a record label and entire movement set up to spread the Gqom music and culture from the Durban townships. Spreading a consistent and powerful message the label provides a conduit and a pedestal for the joyous aesthetic to be experienced outside also of the South African territory. In terms of vision, label head - Nan Kolè has collated a lexicon of primal and futuristic styles selecting only the most innovative flows to be an intrinsic part of his curatorial pallet. A coarse blend of infectious carnal pop culture paired with a DIY ethos ensures a continuous and inexhaustible supply chain of ghetto infused time-bombs which are creating huge ripples across the atlantic with outlets such as Rolling Stone, Fader and Pitchfork launching acclaim. The Gqom community evoke a tight-knit brotherhood, often displayed at impromptu taxi-rank gatherings where they celebrate life and creativity. Tracks withhold a strong narrative and with a bright timbre, mask any traces of oppression. Gqom has its own conscious and unconscious language, one of erasing suffering, one of defiance and one of projecting a brighter future but on top of all of that it's about dance and freedom of expression.

Jill Scott is a media artist, educator and writer. Her focus is on Art and Science research and she works with creative teams of programmers and AI experts to explore neuroscience, ecology and sensory perception.

URL: https://www.jillscott.org/artwork/current_e_skin.html

Eskin 4 for the visually impaired

Eskin is a long term project to empower blind users with wearable and usable technology, and encouraging participants in workshops to be creative and to customize their own sound and tactile information from local environments. Our aim is to gather cross-model information through local workshops and help users add to the design of the technology itself. Over time, eskin has become a set of wearable interfaces, which constitute our past and present attempts to electronically simulate the perceptive modalities of the human skin: pressure, temperature, vibration and proprioception. These four modalities constitute our biggest human organ, constantly detecting and reacting to environmental realities. The interfaces explore the cross-modal potentials of tactile and acoustic feedback, the enhanced orientation of cognitive mapping and the need to embody the interaction in the digital environment. The content often cumulates from the comments by the workshop participants and can include samples from their daily narratives mixed with trigger points from wearable computing and teachers from improvisational movement. The workshop usually cumulate in performance called Eskin 4 the Visually Impaired. Together with experts the teachers of the workshops encourage the participants to customize and sample sounds and allow for them to be changed in an easy way. The resultant performances provide an insight into heightened levels of sensory perception for others (the seeing audience) while the experience empowers the participants with a high level of creative experience and knowledge exchange that can be reused and redeveloped by these same communities again.

Stefanie Wuschitz and Patricia J. Reis

Stefanie Wuschitz works at the intersection of research, art and technology, with a particular focus on Critical Media Practices (feminist hacking, open source technology, peer production. In 2009 she founded the feminist hackerspace *Mz* Baltazar's Laboratory* in Vienna, encouraging technology that is developed from a female perspective. She is collaborating with scholars in the fields of Human Computer Interaction, STS and Digital Art.

Patrícia J. Reis is an installation media artist based in Vienna (At) whose practice encompasses different formats and media to examine how interactive technology is shaping humans bodily and politically. She is a board member of the collective Mz* Baltazar's Lab, a feminist hackerspace based in Vienna that aims at generating a culture of fearless making and empower creativity.
URL: http://www.mzbaltazarslaboratory.org/about/

Mz* Baltazar Lab

We are a feminist hackerspace in Vienna. We organize queer-feminist tech workshops and contemporary visual art exhibitions at our lab. Mz Baltazar's Lab aims at generating a culture of fearless making! An environment that fosters creativity, activism and provocative thinking! We try to build an accessible, inclusive, open, safer and radical space, from which to evolve as people and as community. Open Source Technology is at the root of our philosophy, it enables us to share and collaborate without restrictions. We need this space to experiment with things as gender, hardware or ourselves. Transparent, open technology (open source technology) is very important to us, because through this kind of shared resource we can learn about software and hardware without any hindrance and develop them together. We need the common framework to play with, and sometimes question, a variety of things, such as gender, hardware, and even our self (or construction). Our workshops are for women, trans, cyber feminists, non-binary artists and feminist hackers…they represent different, sometimes contradicting concepts and strategies. Some to gain agency and visibility, others to enhance tech literacy, to create a room of one's own or a safer space, to manage collective living, to work with a non-binary perspective on gender and situated knowledge, to agree on a code of conduct or an idea of justice. Participants are encouraged to create hands-on objects and artistic prototypes that express our experience and comment on recent national and international events.

Eugenio Tisselli is a media artist and programmer. He is the director of the ojoVoz, a sociotechnical platform for the collaborative creation of community memories.
URL: http://ojovoz.net

ojoVoz - Sauti ya wakulima

Sauti ya wakulima (The voice of the farmers in Swahili) is an ongoing project that aims to provide small-scale farming communities with a sociotechnical platform that enables their reciprocal exchange of agricultural knowledge. Sauti ya wakulima started in 2011, and has helped a growing number of small-scale farmers in different regions in Tanzania to amplify their voices by creating networks of mutual exchange of knowledge, particularly in the context of diverse challenges, such as anthropogenic climate change. In its initial phase, Sauti ya wakulima reached a limited number of farmers living in the community of Chambezi, in the Coastal Region of Tanzania, who used mobile phones to share contents on a collaborative online platform. The

original participants of the project claimed ownership of the project by reshaping its goals, and successfully created a knowledge base of more than 3000 images and sound recordings that reflects their ways of coping with the many challenges they face. In its current phase, the project is expanding and will shortly reach approximately 5000 farmers living in different regions of the country, thanks to the support of Swiss NGO Swissaid and other local organizations. In this new stage, Sauti ya wakulima will be recast as a platform for the sharing of knowledge on agroecology by bringing together farmers and experts from local and international institutions. In this way, the project aims to trigger fruitful and mututally respectful interactions between different domains of knowledge and practice (scientific and farmer-held), while helping farmers in their efforts of taking up more sustainable agricultural practices.

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Mictlan's Cyber-Cartography the Search of Mexican Families for Their Loved Ones: A Collaborative Socially-Engaged Art Project

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Abstract

Mexico is living in an extreme humanitarian crisis since 2006, a crisis that has escalated up to an unprecedented situation. Among the different circles of the horror of this contemporary Mictlán—the underworld for the Nahua culture—, there is one especially painful: the kidnapping of civilians. With more than 30,000 people 'gone missing', and several independent groups searching for clandestine graves all around the country, the situation is unbearable. This paper addresses the making of a collaborative sociallyengaged art project that enables a collective of women based in Los Mochis to document their search for their loved ones in rural and urban areas of Mexico.

Keywords

Mexico, cyber-cartography, collaborative, creative-practice, practice-as-research, socially-engaged, human-rights, Mictlán.

I

Since 2006, Mexico is living in an extreme humanitarian crisis. More than 33,482 individuals have been kidnapped (Martinez, 2016), and the dead toll of this *war against drugs*—as it was called by former Mexican President Felipe Calderón—is 234,000 (Hernández Borbolla, 2017) by the end of 2017. The general opinion among civilians is that "local police departments are allied with criminal gangs, and have little incentive to recover the bodies of citizens—the *desaparecidos*—kidnapped for ransom, robbery or revenge and never found again" (Maharaj, 2016). Family members of those abducted, tired of visiting police headquarters, hospitals and clinics, even morgues, and being told to wait for "news" on their cases, started to investigate—a task that should be done by police—and to search for clandestine graves. "We are finding things that authorities never wanted to look for" […] "We are doing their work, because we want to find our children" (McDonnell, 2016) explained Rosalía Castro, a mother that has been looking for her son Roberto for four years already in the state of Veracruz.

Rosalía Castro is part of the El Solecito Collective, in Veracruz, a group of women and men that found several mass graves this area of Mexico; but there are other collectives in Jalisco, Coahuila, Tamaulipas, Nuevo León, Estado de México, Sonora and Sinaloa, just to mention a few states.

These collectives share an impromptu system: they meet several days a week—either in an office, a house, a specific point in the city—, they prepare their expedition, and then they just drive to the places they agreed in a private agenda. They have limited and sometimes scarce tools, like machetes and shovels, but especially, they bring several metal rods—in the shape of a T—that help them to get a better clue in case there is a grave underneath: they push it down and when pulling the rod out, by smelling the very point, they may know if there are any bodies buried there.

II

Journalists are following the activities of these collectives, providing them with more 'visibility' that could translate—not always—as a sense of protection. Some of the journalists that work in smaller cities in Mexico live in a state of precariousness, sometimes as freelance—working for different media organizations—, with no support from the editors or owners of the newspapers, with no special training or equipment to go and do their job. *Periodistas de a Pie* is "a network of national and international journalists who are experts in social issues and human rights" (Pastrana, 2017). This network has followed this cause, making media productions to help understand better this humanitarian crisis. With the support of Open Society Foundations, *Periodistas de a Pie* produced the project 'Buscadores. En un país de desaparecidos' which means *Seekers. In a country of disappeared*. The general editor is Daniela Pastrana, project designers are Consuelo Pagaza and Prometeo Lucero, and drawings are made by Rafael Pineda. In this project, Mexican journalists introduce seekers' profiles through short videos. The list of 'buscadores' include: Mario Vergara, Silvia Ortiz, Alma Rosa Rojo, María Herrera, Graciela Pérez, Fernando Ocegueda, Guadalupe Contreras, Mirna Nereida Medina, Araceli Rodríguez, Alfonso Moreno, Leticia Hidalgo, and José Díaz Navarro.

Figure 1. Buscadores. © Periodistas de a Pie / Pie de Página. URL: http://piedepagina.mx/buscadores/index-.php.

The project introduces videos of each one of the individuals that are searching for their family members. This is an ongoing project, that is being nurtured by members of Pie de Página collective.

III

Scholars working in public and private universities in Mexico have been studying this phenomenon, and they have presented their research results in conferences and symposia like Colegio de Mexico 'Violence and Peace Seminar' coordinated by Sergio Aguayo, or Colegio de Michoacán conference 'Sovereignties at stake. Insights from citizen security in Latin America.'

There are some scholars that work together in order to provide training to the collective of 'searchers' or 'buscadores,' that is the case of GIASF, a Group of Research in Social and Forensic Anthropology.

Figure 2. GIASF. © http://www.giasf.org/asesoriacutea-teacutecnica.html

One of the workshops they have been providing is 'Search, localization and registering of contemporary discoveries' in which "the GIASF has developed a flexible model of technical advice to relatives of disappeared persons and their representatives on the generalities of anthropology and forensic archaeology in the search and identification of human remains. It is a horizontal learning methodology that focuses on the needs of victims." (GIASF, 2015).

As stated in their website, "more than 200 family members have attended these workshops in Mexico City, Veracruz, Coahuila, Sinaloa, Baja California and Chihuahua." (GIASF, 2015).

IV

Journalists help us understand better what is happening, contextualizing the situation, providing information, making visible these groups of citizens in their search. Scholars provide deep data, delivering elements to make sense of the storm the country has fallen. Their subject of study are these citizens. They interview them, film them, record their words, document their activities.

But these individuals, at the end, when journalists and scholars leave, are left by themselves, alone, with the regular tasks of being alive: cleaning dishes, looking for the family children, cooking, cleaning the house.

They rely on social media to share their experiences with other individuals that are going through the same *inferno*.

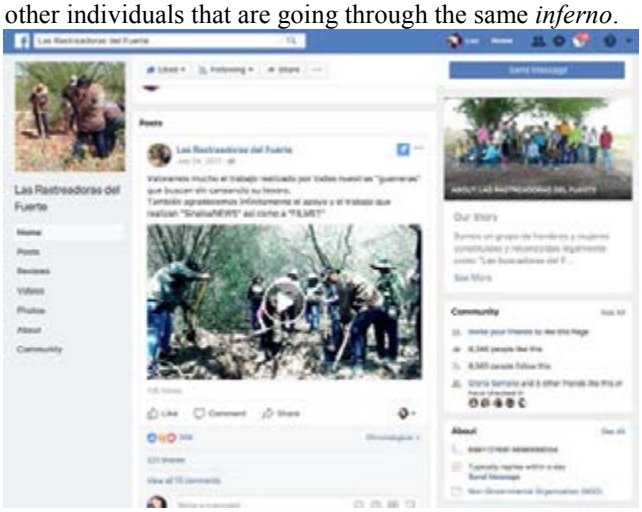

Figure 3. Las Rastreadoras. © https://www.facebook.com/Las-Rastreadoras-del-Fuerte-267629457048946/

They give 'likes' to other's stories, they forward information on missing persons, they write a little word of hope, they circulate videos of their own search and findings, or they look for company by sharing their commitment to their loved ones.

""For years, many of us felt isolated, like we were the only ones going through this," recalls Diaz, who has been consumed by the search for her son, Luis Guillermo Lagunes Diaz, a popular disc jockey and events promoter in Veracruz who was last seen June 28, 2013. "We have since found out there are hundreds, thousands of others going through the same emotions, the same pain. Now, we can share it."" (McDonnell, 2016).

There is a need to register their day to day, to be part of a wider community, to be seen and to be heard. There is a need

to tell their stories: who their sons or daughters were, what they did for living, their favorite meal, anything that can keep their memories alive and fresh, as a way to survive.

Figure 4. Las Rastreadoras. © https://www.facebook.com/Las-Rastreadoras-del-Fuerte-267629457048946/

Even if there is a big chance for this 'desaparecidos' to be dead, there is hope: "Te buscaré hasta encontrarte" or "I'll look for you until I find you", means that they will be searching until they recover their loved ones, alive or lifeless.

V

The third production of the long-term creative research project *Vis. [un]necessary force* (2014-2020) is a collaborative socially-engaged endeavor that consists on the construction of a tool that will enable Las Rastreadoras—the collective of women based in Los Mochis—to build an online database and map that will mirror their search in the rural and urban areas of Mexico.

Vis. [un]necessary force is a creative research project that explores how civil population survives amongst extreme violence performed by legit and non-legit groups of power in specific areas of Mexico. The project explores the consequences of the violence in the daily life, especially among family members of missing individuals.

V. U[n]f_3 is a multimedia testimonial, which uses geolocation, audio recording—accompanied by photographic and textual elements—that will generate a map of the significant places-landscapes for the relatives of the disappeared. *V. U[n]f_3* is an artwork that would allow for the construction of a map—made of sound, texts and images— of the explorations carried out by Las Rastreadoras in Mexican rural and urban areas.

The collaborative work included participating in their expeditions, understand the way in which the collective works, making a tool that will be user-friendly, design the front of the application with them—from the colors to the fonts—and finally testing the app on-site in order to deliver a useful tool for them to incorporate in their day to day live.

Figure 5 screen shot from *V. [u]nf_3*. Work in progress. © Luz María Sánchez.

The core of *V. U[n]f_3* has three elements. The first one is the design and development of a tool that mimics a social network, but in this case, it is a private one, just for the use of the group Las Rastreadoras. They are able to upload their photos, to record voice notes or ambience sounds, to write a note. All these data go online to a database, and is visible—for the closed group—in a map. The second element, that is designed in collaboration with GIASF, is a tool that has to be used by certain members of Las Rastreadoras, in order to fill the database with reliable data: places where they are looking for their family members, people participating, characteristics of the area in which they are searching, pictures of the terrain before start digging, with protocols before and after the finding of clandestine graves.

But the third element relies on the fact that the artist 'as producer of knowledge', the artist 'as producer of symbolic objects,' in this case, gives way to each of the women that participate as Rastreadoras, to make their own symbolic objects using this tool. Their photos and sounds and texts, their path, their findings. A private construction. As Harun Farocki stated, I reclaim the "not-me" or "non-moi" "comme condition essentielle" (Didi-Huberman, 2010: 188)—in his work of restitution of images.

Through *V. U[n]f_3* I am looking forward to delivering a useful tool for social scientists to work along with this collective. But more important, I would like to imagine for this tool to be used by Rastreadoras, and little by little, to build a place for mourning and remembering; a tool that may disclose the search and findings of these brave group of women in their journey to Mictlán, in order to bring back their family members from anonymity and silence, and to give them proper burial.

In Mexico, we need to be companions, and go deep into this contemporary Mictlán, and come back, and say what we saw: be the witness and speak the horror.

Acknowledgments

The team collaborating in this project is Romain Ré, Ana Paula Sánchez-Cardona, Tania Reyes, and GIASF: Research Group on Social and Forensic Anthropology, especially Carolina Robledo Silvestre.

References

Martínez, F. (2017, September 8). *Sin precedente, el número de personas desaparecidas en México*. Retrieved from http://www.jornada.unam.mx/2017/09/08/politica/010n3pol.

Hernández Borbolla, M. (2017, November 11). *Peña y Calderón suman 234 mil muertos y 2017 es oficialmente el año más violento en la historia reciente de México.* Retrieved from: http://www.huffingtonpost.com.mx/2017/11/23/pena-ycalderon-suman-234-mil-muertos-y-2017-esoficialmente-el-ano-mas-violento-en-la-historiareciente-de-mexico_a_23285694/.

Maharaj, D. (2016, October 3). *Disappeared; Colombia Voters Say No to Peace Agreement*. Retrieved from: http://www.latimes.com/newsletter/la-me-todaysheadlines-20161003-snap-story.html.

Simèon, R. (2010). *Diccionario de la lengua Náhuatl o mexicana*. Mexico: Siglo Veintiuno Editores.

McDonnell, P.J. (2016, September 29). *'Mexico is one big cemetery': The search for the secret graves of 'the disappeared.'* Retrieved from: http://www.latimes.com/world/mexico-americas/la-fgmexico-missing-20160929-snap-story.html.

Pastrana, D. (2017, December 1). 'Buscadores. En un país de desaparecidos'. Retrieved from: http://piedepagina.mx/buscadores/index-.php.

GIASF. (2015). *Asesoría técnica a familiares de personas desaparecidas.* Retrieved from: http://www.giasf.org/asesoriacutea-teacutecnica.html.

Didi-Huberman, G. (2010). *Remontages du temps subi. L'oeil de L'histoire, 2*. Paris: Minuit.

The Dark Side of Making –
Reflecting on Promises, Practices and Problems of the Last 25 Years

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Abstract

The discussion of our panel of the *Dark Side of Making* takes up specifically the perspectives of software- and biohacking, do-it-yourself (DIY) practices, education, and open networks. Members of the panel represent a range of perspectives from an international group of academics, artists, and makers, including the local South African maker scene. The recent years have seen a growing interest and increase of practices that embrace a DIY attitude and Maker Culture. But there are also controversies attached to these practices that question their legitimacy, sustainability, and intentions: How is it better to build your own electronic device instead of buying a mass-produced one? Does it really make sense to self-build the automated watering, light and temperature control system for your house plants? And why do we all repeat the same experiments in a DIY biolab, e.g. the creation of transgenic fluorescent e-coli bacteria, which will be killed after we have seen it glow under a fluorescent lamp? These and other questions reference a possibility that there exists a dark side to these practices; but what and where is it?

Keywords

Biohacking, creative practices, critical perspectives, digital media, DIY, education, hacking, Making, open culture, open networks.

Introduction

Making, DIY, craft, hacking, biohacking – these practices are often perceived as empowering and liberating to the practitioners. They are seen as an alternative to a consumer culture and often claimed to question and flatten hierarchies. Proposedly, they effectively facilitate learning and empower citizens. This popular, if not predominant, reading of Making appears to focus on its perceived emancipating elements (e.g. Gershenfeld, 2012). As the recent decade has experienced a stark growth of these types of practices, it is time to step back and ask critically if there are 'dark sides' accompanying them. Are makers building a kind of frankensteinian monster (Fig. 1), that will haunt them? Are there situations where these practices "go wrong" – intentionally or unintentionally?

Figure 1. Building a *Making* monster.

Our panel aims to initiate a critical discussion by reflecting on the popular phenomena and their associated practices, underlying understandings and commitments, as well as scrutinizing the reality underlying the common rhetoric. The panel is meant to constructively question and challenge the current situation, and develop desirable scenarios for the future in discussion with the audience. The topic of *Dark Side of Making* is approached from a wide range of perspectives, such as political, philosophical, artistic, educational and design theoretical discourses. The conceptual framework of this discussion can be defined as a 'critique of openness' exemplified by concrete Making and hacking practices. Some of the potential issues addressed by the panel are concerning the situations and ways the practices become hijacked to other ends than what was the original vision? Who invests into and benefits from cultures of openness? Are there *dark sides* in educational practices? What kind of relation to the natural environment develops through DIYbio practices? What kinds of side-effects do these practices entail? The panel aims to establish a dialog with the audience addressing these questions in the specific local context to identify international differences in attitudes and practices in cultures of making.

A brief look into history

In the late 1940s, John von Neumann proposed in his lectures a thought experiment on a kinetic, self-reproducing automaton, which he later developed into the cellular automaton – today known also as the *Game of Life* (von Neumann, 1966). The concept of self-reproducing machines had existed for a long time when von Neumann proposed his concrete and realizable version of it. Today the same idea is still present and underlying parts of the developments in the fields of computation, robotics and also biotechnology with its interests to manipulate and even create biological life (Gibson et al., 2010). One can also claim that this very idea has been lurking behind various developments within DIY fields. A machine that can reproduce or print itself has been one of the visionary claims that have pushed forward contemporary ideas about democratizing production. A situation has been imagined in which anyone can afford to print anything anywhere. This vision has been approached by DIY practices with the development of low-cost equipment accessible to a considerable portion of Western populations.

When one looks into the past of the Western world, one can detect an emerging trend in participatory practices of end-users of technical media. Since the mid-1980s various forms of DIY subcultures have emerged, and continue to exist, but they have often focused more on craft and repairing using traditional materials in traditional settings (e.g. sewing, vehicle mechanics, gifts, decorations, and other handicrafts). The more recently emerged practices have centred around technical media with examples such as the *hacking* of online computer systems, and of software in general (i.e. creating it). Later appeared *Making* and *Maker Culture* that use Fab Lab technologies (such as laser cutters and 3D printers) and easily available computers and small-scale microcontrollers such as *Arduino* boards and *Raspberry Pi* controllers. A common motif in these developments has been the empowerment of the users (or citizens), preserving or (re-)taking control of their own affairs, questioning hierarchies and aiming to reverse power relationships.

We observe several reasons for the emergence of the bottom-up, participatory movements: (1) The popularization and spread of the digital computer into private households, and the explorative and playful modalities of interaction it promoted or even necessitated (Cermak-Sassenrath, 2015). It also introduced users to some appropriative (if not outright illegal) practices such as swapping (or trading) copied games and other software. (2) The World-Wide Web which experienced a massive surge of popularity in the late 1990s and sustained initiatives such as the EFF, the 'Declaration of Independence of Cyberspace' by Barlow (1996), the Open Source movement, and the Linux operating system. (3) As a reaction to the perceived takeover of many areas of life by computer systems, programs and algorithms which were seen, at least initially, and periodically after that, in parts of the population with reservations, if not with fear and hostility. (4) The possibilities afforded by new production tools to construct DIY and low-cost equipment; that have opened up areas for DIY development, which have been restricted before to experts within academic institutions and commercial enterprises, for example in areas such as hardware development, physical computing, life science and biotechnology in general.

Perspectives of *Making*

From early on, the use of digital media questioned existing conventions and frameworks of conduct, policies and laws. The first hackers at MIT used computers more or less illegally (Levy, 1994); hackers aimed to use dial-up data connections free of charge (*blue boxing*); gamers removed copy-protections from games (or used special tools) to be able to swap them; people exchanged manuals online for all kinds of unlawful activities (from breaking in, to building weapons, to producing drugs); among many other examples.

Educational aspects have been strongly present throughout all DIY-practices, Making and hacking. Within the Making community, there appears to be a belief that educating the general public with new skills and enabling them to build low-cost equipment will democratize the production of knowledge and, ultimately, society. However, if one scrutinizes the situation from an institutional educational perspective, there are several problematic aspects connected to Making which can spark conflicts: Making might purely replace one learning material with another, without questioning and revising the established contexts. Despite the introduction of innovative forms of teaching and learning, traditional forms of assessment such as oral exams might prevail. Making might promote a trivialization of learning, and students might mistake reproducing for understanding, artefact for concept, and product for result. Making might reveal itself to not be a way to individual and collective empowerment but a strategy of social control (Kozlovsky, 2007).

Digital media and communication networks have certainly facilitated a change of perspective for a rapidly increasing number of people. This has also impacted the attitude of consumers – for example, areas such as culture, politics and the economy are no longer something that one accepts as given, but something one can be involved in. Andreas Reckwitz (2017) points out that the currently prevalent focus on innovation within companies has provided a precondition for the universal regime of novelty that has become inherently a part of the so-called aesthetic economy. Economists are keen to promote creative industries that are deeply invested in the production of novelty and contributing to the aesthetic economy. DIY practices are often intertwined with creative industries and either directly or indirectly contribute to it. Two clear consequences, among many others, have emerged within these developments – the appearance of new workforce of the masses that is known in new-media lingo as crowdsourcing, and a new type of ‘creative consumer’ has emerged which is something between a producer and a consumer.

These developments have also led to the notion of so-called prosumer (producer + consumer) capitalism (Ritzer, 2015).

In the common rhetoric of *open culture* there is a common trope in which the network is a distributive structure that flattens hierarchies, disintermediates communications and creates equality of opportunity and outcome. However, simultaneously as networks become pervasive we see the opposite situation taking shape. The free flow of capital, resources, people and information leads to ever greater aggregations in each of these categories, highlighting an increasingly widening gap between rhetoric and reality. Neither networks nor the ideals of open culture have been able to impact the facts that e.g. capital is flowing to ever fewer pockets and social media is today known for creating ever-stronger eco-chambers that amplify existing beliefs and consensus. To what extent is the distributive function of the network exceeded as the network gains scale? One cannot help wondering what makes us believing in the rhetoric when reality presents us with contradictory and harsh facts?

A comparable strong rhetoric about equal opportunities and democratic decision making also surrounds the practices of biohacking, DIYbio and even biotech-based artistic practices. During the recent years, there has been a considerable increase in general interests towards these biology-related practices, which have emerged alongside of the above-described DIY and hacker movements that focus on technical devices and digital media. These practices typically concern of biotechnological methods for manipulation of living organisms. They also present one of the long-term dreams of scientists working within the field – the creation of life from scratch. This dream echoes strongly with the proposal of self-reproducing automata, which von Neumann visioned at the time as a mechanical machine; today however, this dream of creating life is projected onto the engineering possibilities within the field of biotechnology.

In the 1780s, Italian physician Luigi Galvani investigated the effect of electricity on dissected animals (Fig. 2). He discovered that a frog's legs twitch when electricity is passed through the muscles, a phenomenon called galvanism that led to the subject of electrophysiology (Lai, 2017). This is a historical experiment, which may today look to us rather dubious. It can also be seen as an early experiment that combined technology and biology.

Today's DIYbio practitioners often see themselves as a counterculture in opposition to the commercial biotech industry. They design and construct low-cost tools that are able to do the same tasks than expensive proprietary equipment in the laboratories. These tools are made as open source with an idea in mind that the tools can empower citizens to take part in the development of science and technology. But one can still question what is different in the DIY practices in comparison to industry research – is the ultimate goal not still the same; to innovate and create economic profit at the end? The shared ideology across DIYbio communities assert to open access, equal opportunities, and sharing of knowledge as the primary model of working. But there exists also a general belief surrounding the field, which presumes that the next big innovation in biotechnology will come from the DIYbio communities (Lorenzo & Schmidt, 2017). One can refer to this situation and question the persistence of the pronounced ideology, as well as one can easily point a finger to many ethical aspects (from western perspective) concerning the work with living organisms, or to the side-production of waste within laboratory practices. There are many obvious dark aspects present in today's biotechnology practices both in DIYlabs and in the research & industry. However, the panel-talk will not concern of pointing out these very obvious dark sides in the DIYbio practices, but rather investigates the existence of the technologically defined mind-set that treats everything (living and non-living) with a rational and top-down logic, and considers the natural environment predominantly as a resource to humans.

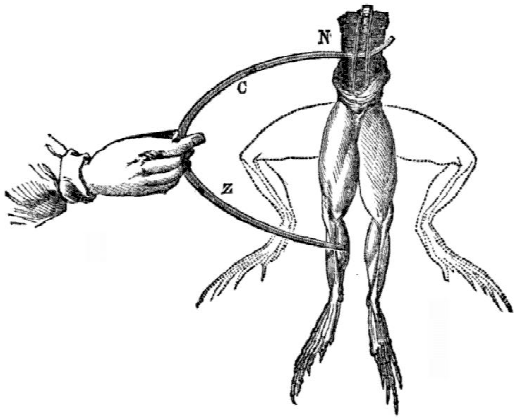

Figure 2. Luigi Galvani's 1780s experiment with frog legs and electricity (Wikimedia Commons[1]).

Our proposed panel discussion of *The Dark Side of Making* takes up perspectives of software-, hardware- and biohacking, including DIY-practices, education, and open networks. The panel presents a range of perspectives from international group of academics, artists, and makers, including the local South African maker scene.

References

Cermak-Sassenrath, D. (2015). Playful computer interaction. In V. Frissen, S. Lammes, M. de Lange, J. de Mul, & J. Raessens (Eds.). *Playful Identities. The Ludification of Digital Media Cultures* (pp. 93–110). Amsterdam: Amsterdam Univ. Pr.

Gershenfeld, N. (Nov/Dec 2012). How to make almost anything. The digital fabrication revolution. *Foreign Affairs*, 91 (6), 43–57.

[1] https://commons.wikimedia.org/wiki/File:Galvani-frogs-legs-electricity.jpg [accessed Apr 12, 2018]

Gibson, D. G., Glass, J. I., Lartigue, C., Noskov, V. N., Chuang, R.-Y., Algire, M. A., Benders, G. A., Montague, M. G., Ma, L., Moodie, M. M., Merryman, C., Vashee, S., Krishnakumar, R., Assad-Garcia, N., Andrews-Pfannkoch, C., Denisova, E. A., Young, L., Qi, Z.-Q., Segall-Shapiro, T. H., Calvey, C. H., Parmar, P. P., Hutchison III, C. A., Smith, H. O., & Venter, J. C. (2010, July 2). Creation of a bacterial cell controlled by a chemically synthesized genome. *Science*, 329 (5987), 52–6. Retrieved from science.sciencemag.org/content/329/5987/52.

Kozlovsky, R. (2007). Adventure playgrounds and postwar reconstruction. In M. Gutman, & N. de Coninck-Smith (Eds.). *Designing Modern Childhoods: History, Space, and the Material Culture of Children. An International Reader* (pp. 171–92). New Brunswick: Rutgers Univ. Pr.

Lai, A. (2017) The Experiment That Shocked The World. *Helix Magazine*. Retrieved from https:// helix.northwestern.edu/article/experiment-shocked-world.

Levy, S. (1994). *Hackers – Heroes of the Computer Revolution*. 'Online' Electronic Edition. Retrieved from mitya.pp.ru/chamberlen/hackers/cover.html.

Lorenzo, V., & Schmidt, M. (2017). The do-it-yourself movement as a source of innovation in biotechnology – and much more. *Microbial Biotechnology*, 10 (3), 517–19. doi: https://doi.org/10.1111/1751-7915.12715.

Reckwitz, A. (2017). *The Invention of Creativity Modern Society and the Culture of the New*. Cambridge: Polity Pr.

Ritzer, G. (2015). Prosumer Capitalism. *The Sociological Quarterly*, 56 (3), Routledge, 413–45. doi: https://doi.org/10.1111/tsq.12105.

Von Neumann, J. (1966). *Theory of Self-Reproducing Automata*. A. W. Burks (Ed.). Urbana: Illinois Univ. Pr.

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Dr. Laura Beloff (FI/DK) is an internationally acclaimed artist and academic researcher who has been actively producing art works and exhibiting worldwide in museums, galleries and art events since the 1990's. She has been a recipient of various grants, art residencies and awards. Her artistic and research interests include practice-based investigations into a combination of technology and biological matter, which is located in the cross section of art, technology and science. Previously, she has been Full Professor for Media Arts at the Art Academy in Oslo, Norway; and Visiting Professor at The University of Applied Arts in Vienna; and currently she is Associate Professor and Head of the PhD school at IT University of Copenhagen. www.realitydisfunction.org

Julian Priest is a New Zealand based artist and writer who works with participatory and technological forms currently focusing on gravity. He was co-founder of early wireless freenetwork community Consume.net in London and is a board member of the Aotearoa Digital Arts Trust. He has lectured at the Banff Centre, Whanganui School of Design, AUT University and Massey University. Recent exhibitions include: The Blue Marble, Machine Wilderness, Public Art Finalist Exhibition, Albuquerque (2012); Sink, Machine Wilderness, ISEA, Albuquerque (2012–13); and Local Time, Local Knowledge, Dowse, Wellington (2011–12). His interactive sound work La Scala was recently commissioned for the Chartwell Stairwell at Artspace Auckland (2014–15).

Walter Langelaar is Programme Director for Media Design in the School of Design Victoria University of Wellington (NZ), as well as an artist and subcultural activist from the Netherlands. His work in media arts and design questions our digitally networked cultures and infrastructure in varying dimensions through sculpture, installation, online performance and critical intervention. Walter's work is shown in numerous venues across the European and international media arts scene. Walter received several awards for his personal and collaborative projects and held artist in residence and visiting scholar positions. Walter's research is concerned with the plethora of recording devices employed in the post-Snowden spheres of networked interaction design. The recently launched SAM project (2017) aims to raise awareness as well as pose critical perspectives on AI cloud infrastructure, blockchains and social media mining while contextualising these tools in relation to contemporary Internet culture, political science and e-governance.

Natural born innovator, trained Engineer, Teacher, Artist and Entrepreneur – Steve Gray (BSc Eng) is a dynamic voice in the world of Technology and Innovation. Founder of the MakerSpace Foundation, he is a master at demystifying technology and unpacking the human implications of our rapidly changing world. Stephen offers an entertaining and insightful look behind the Tech curtain, unveiling a picture of the future and engaging listeners from all walks of life.

Ecological Aesthetics

Artful tactics for humans, nature, and politics

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Abstract

Stories that think and change; stories that deconstruct and distill; stories that make and provoke new stories, new pasts, presents, and potentials – all felt and thought, both affectively, and upon reflection.

Introduction

My new book, *Ecological Aesthetics: artful tactics for humans, nature, and politics* (Dartmouth College Press, to be released 3 July 2018) reminds us that stories are simple, but precious – and, perhaps, a bit too rare in current critical discourses. And they are the "artful tactic" with which I propose we mostly orient ourselves towards concern with the world: with humans, nature, and politics, with how we move-think-feel and act. I give in-depth narratives around about ten artists and their artworks, over ten sections, like a gentle manifesto, moving between strong statement and rich description, thoughtful definitions and punctuated rhythms.

An "ecological approach" takes account of agents, processes, thoughts, and relations. Humans and non-humans, matter and concepts, things and not-yet things, politics, technology, economics, and industry, for example, are all actively shaped in, and as, their interrelation. And "aesthetics" is five things: what can be said, shown, experienced, or practiced; what is said, shown, experienced, or practiced; how it is said, shown, experienced, or practiced; why it is said, shown, experienced, or practiced; and, most importantly, the stakes therein. It is, overall, a style of, and orientation towards, thought, and thus action.

For ISEA, I am proposing a paper and roundtable / panel discussion with four of the artists / art collectives I write about in this forthcoming book, to explore new forms of media-based art activism, which have us encounter a politics of generosity and beauty in the everyday, through stories, friendships, protests, walks, and other relationship-forms that cultivate looking, seeing, feeling, acting, and change.

Milwaukee's Overpass Light Brigade in action

For example, Durban-based, Mauritian-born artist and architect Doung Anwar Jahangeer's failed attempt at suicide resulted in a new life of walking and talking, teaching and learning, between his habitat and communities. Inspired by Michel de Certeau's "Walking in the City" (1984b), Jahangeer continues this book's argument in showing us the difference between tactics and strategies, and the importance of vulnerability in the everyday. He takes interested parties on long walks around Zululand, and his politically charged but always generous artwork is literally an experience and practice of movement, a relation to others and their/our environments. Jahangeer points out what he calls the "organic intelligence" of cities, society, nature: emerging ecologies.

Or, former ISEA Co-Director Malcolm Levy makes prints and videos that are reminiscent of glitch art, which purposefully makes use of errors in media storage and/or playback formats as part of its aesthetic, most often inviting an experience of media's materiality, and/or our relationships to its concepts and forms. This artist's works present what happens when we accent how contemporary electronic sensors move and think and feel and break—at least in terms of what we have come to want and expect from today's consumer-based, "postinternet" technologies. Postinternet does not mean "after" the internet, but rather after its incorporation into the everyday: art and aesthetics that address the World Wide Web's (and broader contemporary technology's) effects on culture, society, and dialog.

a Doung Anwar Jahangeer *City Walk*

It is often talked about alongside the "new aesthetic," which refers to the increasing use of machine and digital ("new" media) images and forms in our physical and aesthetic world. Glitch, drone videos, augmented reality, surveillance, and GPS-generated maps and views are all examples of the new "born digital" aesthetic. Levy and his materials, processes, and images challenge the standard narratives we tell each other about computers—what they are, and do, and afford—and gift us with new ones, and thus new possibilities. Here we engage with Richard Grusin's "Radical Mediation" and Jussi Parikka's Anthrobscene to speculate on, wonder about, and move around those human constraints we thrust upon our machines, with microcontrol. What are their unseen impacts and ethical implications? Levy's other-frames bring to the fore the materiality of digital information, and images, and tools, and the inherent politics of how we make and relate to them.

The Overpass Light Brigade turns left-leaning Twitter sound bites into collaborative, physical messages that light up bridges for drivers and pedestrians to reflect on, or participate in. We will discuss how the team brings together individuals, each holding one lit-up alphanumeric character, to display changing activist messages on highways and at rallies. Theirs is a community of practice, a ripple effect of connections always a part of, and making, bodies, texts, meanings, policies, stories. This section pieces together Jean-Luc Nancy's being-with of matter and people and things, and simultaneously exhibits the ecological connections of many (and implicitly all) contemporary activist practices.

one of Malcolm Levy's *Other-frames*

Sean Slemon's *Goods for Me*

Finally, we will go on to contrast aesthetic versus ethical approaches to life and decision-making. South African-born and New York-based artist and teacher Sean Slemon produced *Goods for Me* (2011) and other tree-based works, where he pulls, breaks, or cuts down each of a tree's components—large and small leaves, various-sized branches, the trunk and roots—and compartmentalizes them into individual frames, like a cabinet of curiosities. These sculptural installations, which also house live bugs and ongoing decomposition, articulate nature and culture as continuously moving—and thus changing—together, and over varying timescales. Here we have an immediately felt experience—what Alfred North Whitehead calls "self-enjoyment" (1968: 150) and Eduardo Kohn calls an "aesthetic of the immediate" (2002: 70)—which also has us "concern" ourselves with the before and after, with the outside that both made for this occasion of experience, and where, with our help, it might be heading afterward (Whitehead 1968: 167). Overall, style and aesthetics, wonder and beauty, can have us think-with, and thus aim toward, a better future.

The everyday notion of representation could mean "to depict," or "to present again" (re-present), but Jean-Luc Nancy asserts that the "re- of the word representation is not repetitive but intensive . . . mental or intellectual representation is not foremost a copy of the thing," but an intensified presentation. It is "a presence that is presented" (Nancy 2007: 36; emphasis in original). The re- in represent is, in other words, an amplification; to represent is to present more of what is. Thinking further still, re-presenting could refer to the potency in and of the present. Here we move-think-feel with our present, and all the things (actions, objects, entities, and time itself) that led to this moment and encounter, all the things (conceptual, material, temporal, and otherwise) that might unfold from now. The present, and all that it is, is always more, is always present in its own fullness, and present as the things past and things to come; it can and should always be felt, both ecologically and aesthetically. To re-present in this way is to present our present (and more) as a presence.

Every aesthetic orientation is an ethical one, and vice versa. This panel is an experience and a practice, a call for experiences and practices, that takes account of aesthetics, ecologically (and ethically). And it ultimately asks us to do precisely this. Tell stories. Yours, each other's, the world's; tell stories of the things that matter.

Ecological Aesthetics (the book) and this panel are not about art – at least not exclusively. They ask us to continuously think- and act-with the world and its inhabitants, both human and nonhuman; to orient ourselves in ways that we might find and express what our environments, and what they are made of, want; and then to decisively help and continue those thoughts, wants, and actions along their way. More on the book project at http://ecologicalaesthetics.net; it's available via for pre-order Amazon at http://amzn.to/2lyREAk

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Nathaniel Stern < http://nathanielstern.com >is an artist and writer, Fulbright and NSF grantee and professor, interventionist and public citizen. He has produced and collaborated on projects ranging from ecological, participatory, and online interventions, interactive, immersive, and mixed reality environments, to prints, sculptures, videos, performances, and hybrid forms. His first book, Interactive Art and Embodiment: The Implicit Body as Performance (Gylphi 2013), takes a close look at the stakes for interactive and digital art, and Ecological Aesthetics: artful tactics for humans, nature, and politics (Dartmouth 2018) is a creative and scholarly collection of stories about art, artists, and their materials, which argues that ecology, aesthetics, and ethics are inherently interconnected, and together act as the cornerstone for all contemporary arts practices."Technological, thought-provoking and unexpected" (NPR) Stern has been dubbed one of Milwaukee's "avant-garde" (Journal Sentinel), called "an interesting and prolific fixture" (Artthrob) behind many "multimedia experiments" (Time.com), "accessible and abstract simultaneously" (Art and Electronic Media web site), someone "with starry, starry eyes" (Wired.com) who "makes an obscene amount of work in an obscene amount of ways" (Bad at Sports) – both "bizarre and beautiful" (Gizmodo). According to Cory Doctorow at Boing Boing, Stern makes "beautiful, glitched out art-images," and Caleb A. Scharf at Scientific American says Stern's art is "tremendous fun," and "fascinating" in how it is "investigating the possibilities of human interaction and art." Stern is an Associate Professor of Art and Design in Peck School of the Arts at the University of Wisconsin – Milwaukee, and a Research Associate at the Research Centre, Faculty of Art, Design and Architecture, University of Johannesburg.

References

Bateson, Gregory. 1979. *Mind and nature: A necessarunity*. New York: Dutton.

Bateson, Gregory. 1972. *Steps to an Ecology of Mind: Collected Essays in Anthropology, Psychiatry, Evolution, and Epistemology*. United Kingdom: Intertext.

Bennett, Jane. *Vibrant matter: A political ecology of things*. USA: Duke University Press, 2010.

Boetzkes, Amanda. 2010. *The ethics of earth art.* United States: University of Minnesota Press, 2010.

Cubitt, Sean. "Electric Light and Electricity." *Theory, Culture & Society* 30, No. 7-8 (2013): 309–323.

Cubitt, Sean. 2016. *Finite Media: Environmental Implications of Digital Technologies*. United States: Duke University Press.

Editor, Machine Wildneress exhibition catalog. Albuquerque: ISEA, 2012

Guattari, Felix, Dgenosko Gary, and Ian Pindar. *The Three Ecologies.* United Kingdom: Distributed in the United States by Transaction Publishers, 2000 (1989).

Grusin, Richard. "Radical Mediation." *Critical Inquiry* Vol. 42, No. 1 (Autumn 2015): 124-148.

Grusin, Richard. *Premediation: Affect and Mediality After 9/11*. United Kingdom: Palgrave Macmillan, 2010.

Kohn, Eduardo. *How Forests Think: Toward an Anthropology beyond the Human*. United States: University of California Press, 2013.

Kohn, Eduardo. *Natural engagements and ecological aesthetics among the Ávila Runa of Amazon Ecuador.* Madison (2002): University of Wisconsin. http://zoologia.puce.edu.ec/vertebrados/Recursos/publicaciones/Cientifica/Kohndissertation2002.pdf

Manning, Erin and Brian Massumi. 2014. *Thought in the Act: Passages in the Ecology of Experience*. United States: University of Minnesota Press.

Massumi, Brian. 2002. *Parables for the Virtual: movement, affect, sensation.* United States: Duke University Press.

Massumi, Brian. 2015. *Politics of Affect.* Cambridge: Polity Press.

Massumi, Brian. 2011. *Semblance and event: Activist philosophy and the occurrent arts*. Cambridge: MIT press.

Massumi, Brian. 2014. *What Animals Teach Us About Politics.* United States: Duke University Press.

Nancy, Jean-Luc. 2007. *The Ground of the Image.* New York: Fordham University Press.

Parikka, Jussi. *Geology of Media.* United States: University of Minnesota Press, 2015.

Shaviro, Steven. 2010. "Self-Enjoyment and Concern: On Whitehead and Levinas." In *Beyond Metaphysics?: Explorations in Alfred North Whitehead's Late Thought.*, edited by Roland Faber,

Stern, Nathaniel. *Interactive Art and Embodiment: The Implicit as Performance,* London: Gylphi Limited, 2013.

Stern, Nathaniel. *Ecological Aesthetics: artful tactics for humans, nature, and politics.* New York: Dartmouth College Press, University Press of New England, 2018.

Stoppani, Antonio. "First Period of the Anthropozoic Era," trans. Valeria Federeighi, ed. Etienne Turpin and Valeria Federeghi. In *Making the Geologic Now: Responses to the Material Conditions of Contemporary Life*, ed. Elizabeth Ellsworth and Jamie Kruse. New York: Punctum, 2013.

Weisman, Alan. T*he World Without Us.* New York: Macmillan, 2008.

Whitehead, Alfred North. 1968. *Modes of Thought.* New York: Free Press.

Self-Willed: Flux and Reaction in Systems, Organisms and Materials

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Abstract

Working with a new material inverts the usual design process: the research begins by determining the possibilities inherent in the material, not a preconceived final form. In this reversed strategy function now follows form and form is determined by behavior. As such, the process becomes founded in potentialities. Foregrounding behaviors in reactive materials, systems and organisms is an innovative starting point that can articulate new processes of creative making: design emerges from interactions among force, energy and matter. How do the unique struggles of surrendering authorial control by working with self-willed materials lead to creative advantages and deeper meaning?

Structured as a "Powers of Ten", five creative practices are presented zooming out from the chemical to the cellular, followed by the animal, the human, and the ecosystem. This expanding perspective offers dimensionality in recognizing the creative struggle and transcendence of working with matter that won't sit still. Each project focuses on the non-binary, self-determined moments of life in their chosen materials, when the spark of energies change properties in a messy but meaningful flux. Each member articulates a next scalar relationship to the previous as an example of material potentialities determining outcome within their selected strata. Collectively, they represent how new material behaviors and repercussions create unique opportunities in artistic expression.

Keywords

New Materials, Reactive, Bio Art, Sculpture, Eco Art, Synthetic Biology, Data

Introduction

While much interest in the 'new materialism' is in the forms and applications now possible with emerging resources enhanced through technology, a subset of artists is investigating the moments of transition within them. Material flux, the shift of properties due to natural force, is inherent in our entire physical world and provides rich insight into understanding our environment.

The paper represents five strata in studies of material flux. These creative practitioners are less concerned with the sculpture on the pedestal but instead the hardening of the clay. In each project, it is the behavior of the materials that becomes the core property of the artwork: the behavior of crude chemicals joining, the behavior of wind in Antarctica, the behavior of blood burning.

The energy, change, chance and kinesis in their respective materials are paradoxically both pre-digital and post-digital. Reactions are not binary, they are triggered and result in materials becoming alive, self-determined. This flux-as-life is the artistic impetus in each of these five practices: the chemical mediated, the cellular transformed, the animal augmented, the human hacked, the environment interpreted

Thus, the paper is constructed as the synthesis of an argument ranging from the inorganic to the organic, from the microscopic to the global and from the reaction to the systemic. The dialogue spans across arts education with Tobias Klein showcasing student involvement in the mediation of chemically reactive smart materials as part of the Skunkworks lab and the recording and choreographing of environmental data in the Extreme Environments program presented by Scott Hessels.

Yet, the global scale of the argument surrounding the flux of materials, systems and organisms draws from the mavericks and the most experimental. Dr. Howard Boland's work at the cellular level demonstrates the creation of biological functions not present in nature. Animals as materials will be presented through the use of soft robotics in a colony of mole-rats in the research of Dr. Julie Freeman. The conversation culminates in questioning the relation between all of the panellists topics and their relation to the construct of the human and the human body with its transformational properties, discussed by Jaden J. A. Hastings.

The Chemical: Skunkworks

Skunkworks is a term derived from Lockheed Martin's Advanced Development Program in their revolutionary research environment. The name originally stems from the popular comic strip Li'l Abner in which a moonshine brewery operation was located outside the town of Dogpatch producing malodorous smells by seemingly randomly mixing abstruse ingredients. In Lockheed's case, the infamous smell at the secret laboratories were the result of close proximity to a nearby plastic factory. While anecdotal on the one hand, the project revolutionary research concept of Lockheed's Skunkworks - to give a high degree of autonomy of small groups with the task of working on advanced or secret projects, is the strategy behind the educational experiment in reversing a current trend of designing through simulation and information modelling. Instead, similar to Li'l Abner's seemingly random moonshine distillery, Skunkworks is a project-based approach in designing through material characterized by trial, error, observation, material deduction, resulting in a behaviour design with and through materials. Instead of materials being selected at the moment of fabrication, we are articulating design through iterative material experiments and documentation.

This seeming madness of students working with chemical reactions as the basis of design - an approach of observation and resulting notional control over reactive materiality as environmental and design vector – is juxtaposed by precise and highly controlled digital design workflows such as additive and subtractive manufacturing. Embedded into the design process, Computer Numeric Control (CNC) precision reacts and is adjusted to the flux condition or smart reactive materiality and their highly volatile and non-repeatability. In short, how can working with an uncontrollable – yet influenceable chemical reaction be combined with a highly controlled digital design tools in the form of Computer Aided Design (CAD) and Manufacturing (CAM)? This dialectic pairing between analogue and digital tools, methods and materiality or the lack of, forms new narratives and design processes, leading to innovation of the resulting form, yet as well the design with and through reactivity itself.

In detail, this platform allowed the investigation of materials that react to environmental and shifts in light, temperature, noise, moisture, pollutants. The setup in this material-based design is by nature entropic, unique and resulting changes of color, form or structure, transforming energy from an environmental input into a design language challenges modern fabrication and understanding of standardisation, repetition and optimization. Instead, smart materials and their reactions can become a new form of reactive display design. This emerging media shifts from the independent to the integrated and yield opportunity for a new media art, free from the screen, yet still able to convey information, narrative and aesthetics.

This combination of material based working and digital design emphasizes the dual approach in the workshop as a design methodology situated between testing, exploring documenting and simulating. As such, the work with environmental reactive materials in addition to CAD and CAM acts as a catalyst and testing ground for a design new practice where the uncontrollable reaction is a design process and not result.

The ingredients are 60 highly motivated undergraduate students, two excited educators, over 120 reactive chemical components, innumerable existing and makeshift tools, the proximity to Shenzhen with an incredible affordable additive and subtractive manufacturing industry, 1 computer lab including high resolution 3D scanning devices, 1 makeshift laboratory with only two fire and smoke detectors. The result is a plethora of new concepts and working prototypes where narration, shape, form, behavior, kinesis, surface, patina, tool marks are amalgamated to a reciprocal dialogue between digital precision and conditional reaction.

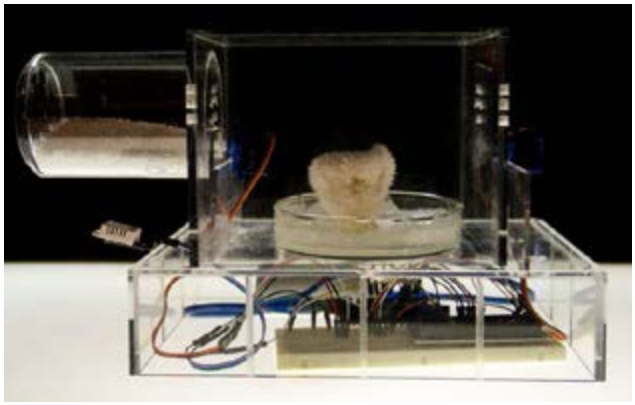

Fig.1 From Skunkworks, student work by Chan, Hin Chung, 2018 a self-regulating crystal growing incubator reacting to humidity to optimize the fragile growth of Urea crystals. © The School of Creative Media, City University of Hong Kong

The Cellular: Synthetic Biology

Synthetic biology aims to design new biological functions and systems not found in nature. While much of these investigation deal with molecular and genetic components, it also involves creating hybrid and pseudo living systems that can made to perform novel biological functions (or unintended by nature). An example of this is shown in Figure 2.

Fig. 2 *Artwork*, 2018, C-LAB, Magnetotactic Bacteria create real-time images, © CLAB

The nature of such materials (e.g. cells, genes and proteins) are intangible in scale, complex in function and sensitive in handling yet their capacity to transform is powerful. Traditionally, it has been difficult to approach material and knowledge needed, but an increasing number of artists are now able to access laboratories and work in this capacity. How then can artists assimilate plastic affordance of the biosciences in art production and what critical issues are at stake? What interfaces can be built to help broker an understanding of 'life' in non-human systems? What physical and biological interfaces can be devised to enable access to this knowledge?

The Animal: Rodent Activity Transmissions

Rodent Activity Transmission (RAT) systems is a collaborative multi-disciplinary project which uses longitudinal real-time data to examine the lives a colony of naked mole-rats *(Heterocephalus glaber)*. At the same time as the electronic tracking and data collection system forms the basis for generating deeper understanding about this unique eusocial mammals' behavior, it also forms the core material for development of digital artworks including visualizations, an abstract animated soundscape, and a series of kinetic forms.

The collection and distribution of data in enables the use of animal behaviour as a real-time dynamic art material. 'This is Nature Now' (TINN) draws on empathic reaction to abstract forms (Heider and Simmel, 1944) to produce a `dynamic-passive' (Candy and Edmonds, 2002) `data sculpture' (Vande Moere and Patel, 2009) consisting of set of real-time biological data-informed soft robotic objects. An example of this is shown in Figure 3.

In TINN, real-time transference of animal activity into dynamic motion in the sculptures raises questions of self-will within the work. The artist designs and establishes a system with hardware and software parameters, according to her artistic intention, yet the rhythms and gestural patterns exhibited in the works are 'driven' by the animals. Additional subtlety in the movements are affected by a number of actors 'internal' to the system: the format of the animal data; the algorithms used to map the data to the hardware; the inherent properties of the silicon material; and the tolerances of the custom-designed pneumatic control system. Due to the unpredictability of the animals and these internal actors, the artist cannot predict the final performance. It could be that this compelling unpredictability provides the *challenge* and the *desire* to create work, placing a demand on the artist to relinquish a certain amount of authorship of the final piece. The *challenge* comes from the ultimate lack of control over the end result, and the addition of uncertainty in the work. The *desire* originates from the thrill of the risk, of the possibility of discovery, perhaps of some 'other' aesthetic or meaning emerging from the known unknown.

The artist refers to the soft robotic gesturing in TINN as a 'body language of objects'. The research-led work attempts to simulate liveness and natural motion through electro-mechanical means to create dynamic data-driven forms with zoomorphic qualities - the quality of self-will.

Fig.3 This is Nature Now 2017 by Julie Freeman, © Julie Freeman

The Human: Xenopoietic Forms

Xenopoiesis is the experimentalisation of an iterative process of "strange-making", whereby material that would once have comprised part of one object undergoes a process of transformation into another, and with it a shift from familiarity toward alienation. When framed within the context of artwork that concerns itself with the bioengineered body, and utilises self-experimentation, unpacking self-hood becomes particularly problematic. The act of separation from the body by medical procedure forces the artist's biomaterial into a liminal state of transition from functional tissue into foreign object. This liminal state is revealed not only in how one refers to the tissue that is excised, let alone transformed, but reflected in both the ethical and legal ambiguity surrounding its ownership status (Skene, 2002; Björkman and Hansson, 2006)

Through a series of artistic experiments—generating 'inert' materials such as glass, pigment, and glaze, as well as a biobank of cryogenically stored cell lines generated from tissue extracted from the artists' body—this troubled state of human biomaterial is revealed through its disembodiment, not for the sake of biomedical utility, but rather toward artistic research (see Figure 4). Traditional classification of human tissue insists upon a duality of living or non-living, yet the material produced in this project appears to exist in myriad states of vitality. Catts and Zurr have long been proponents of recognising a state of 'semi-living', or those entities that sit at the "fuzzy border between the

living/nonliving, grown/constructed, born/manufactured, and object/subject" (Catts and Zurr, 2007). This recognition of both the liminal, as well as dependent state, of cultured human tissue is particularly germane to those cell lines kept in a state of either stasis (cryogenically frozen) or expansion (cell culture). Yet, it is also incomplete to describe that material which is in an 'inert' state as non-living, particularly if we accept the challenge of vital materialism. As Bennett asserts, by accepting the premise that all matter is, in some manner, lively, then all bodies are elevated, and "not only is the difference between subjects and objects minimized, but the status of shared materiality of all things is elevated." (Bennett, 2009).

That this transformed material will continue to manifest into new forms, new bodies (artworks), in an unpredictable, generative manner. Moreover, by creating works of art utilizing the artist's biomaterial, not only archiving one's corporeal being, but also capturing a piece of its natural history, the biological trace of this (the artist's) body intra-acting with its environs to construct its form (an assemblage). The outcome, therefore, of this research does not necessarily reside solely within the resultant artwork, but rather the myriad complexities and uncertainties latent within the development of novel techniques, as well as a body of work, that is fixed upon the artists' own (human) tissue as a creative medium.

Fig.4 *Carbon Black (Blood)* 2017 Jaden J. A. Hastings, © Jaden J. A. Hastings

The Ecosystem: Extreme Environments

Field station research locations offer scientists isolation and immersion for more untainted statistical analysis of climate change and environmental damage. Hong Kong's Extreme Environments program provides art and design students access to these difficult, scientific research sites to partner with expert scientific researchers who share their approaches and tools. Exposure to the most current sophisticated sensor and locative technologies allows the students to measure delicate eco-balances and to produce meaningful data that is inextricably linked to the natural features of the sites. To date, the program has worked with leading climate scientists in four distinct ecosystems: the Mojave Desert, Antarctica, a recently-discovered cave network in central Vietnam, and in two sites in the Coral Triangle: underwater in Sipidan, Malaysia and on disappearing atolls in the Solomon Islands.

Each site has been radically destabilized through climate change and yet the message is still muted in public discourse. Students leverage scientific technologies to find new, innovative ways to give meaning to the onsite findings of science. The immaterial is made material through computational and procedural programming, 3D printing possibilities, screen and projection technologies, robotics, interaction design, kinetic sculpture and more.

The program's first rule is that the artwork cannot exist without direct input from nature. This emphasis on natural energy and force often creates dramatic redirection both on-site and later in the artworks' development. In nearly every student project, a moment has occurred in which the site would not reveal its secrets, e.g. wind studies planned but no wind, currents that would shift out of reach, phenomenon that would appear and then disappear. The loss of authorial control became the critical issue in the in design of the artwork, the dialogue with site was complex, muted, unapproachable, shifting, or a host of other *communication* issues. It is precisely this difficulty of engagement that adds depth of meaning to the works. Flux is surprising and dynamic, just like a real conversation.

The capture and presentation of natural forces being dangerously altered in the Anthropocene provides an unprecedented opportunity to expand our understanding of the feedback loop of a natural environment increasingly informed and shaped by human presence. By creating physical models of scientific research, but accepting the expressive and experiential edge provided by direct presence, the projects demonstrate more than just nature but our complex relationship with it. An example of students working in the field is shown in Figure 5.

Fig.5 *Extreme Environments Antarctica,* 2018 Art students collecting pollutant data, © School of Creative Media, City University

Conclusion

In each project, irrespective of the scale, distinct creative advantages were perceived and realized by releasing authorial control to materials that are self-willed. The unique struggles connected with its unpredictability are perceived as the interesting point of entry, the hook that

pulls each artist in. From there, however, no single aesthetic from this type of practice emerges, as evidenced by the wide range of both the student and profession creative work being realized. Instead, the flux inherent in the materials enabled an extra layering of meaning because the non-human animal, human physiology, chemical and biological worlds, and natural environment all have a great deal to give. Each artist recognized the flux as 'The Other', letting it in, creating a dialogue, and valuing it, whether through authorship, physical behaviour or conceptual meaning.

In response to today's changed understanding of media, matter and materials, this panels sets out to articulate a new multi-scalar and multi-dimensional response to the new challenges and opportunities found in the extension of Art to Art and Science.

Each panellist is working within specific reactive environments, from the microscopic inorganic to the global systemic. Each environment possesses specific design impulses, vectors and resulting material behaviours. Each environment sits at a different scale, yet each is a system that can be interfered with, manipulated and ultimately changed.

The role of the artist has ultimately changed from creator/craftsman to conductor in an interplay of environment, orchestrated material behaviours and entropic systemic processes that shape the resulting art and design. Thus, Art and design has ultimately become unbound from the cumbersome anticipation of the artist as genius in a self-fulfilling prophecy of narratives.

Acknowledgements

Skunkworks is an experimental teaching and learning environment and supported by the City University Teaching Development Grant 6000609

RAT.systems is a collaboration with Dr Chris Faulkes with Marcin Ignac and Prof Kaspar Althoefer, and is supported by Arts Council England and Queen Mary University of London.

References

Bennett, J. (2009). *Vibrant matter: A political ecology of things*. Duke University Press.

Björkman, B. & Hansson, S.O. (2006). Bodily rights and property rights. *Journal of medical ethics*, *32*(4), pp.209-214.

Candy, L. & Edmonds, E. (2002). Interaction in art and technology. *Crossings: Electronic Journal of Art and Technology*, 2(1).

Catts, O. & Zurr, I. (2007). Semi-living art. *Signs of Life: Bio Art and Beyond*, pp.231-247.

Heider, F. & Simmel, M. (1944). An experimental study of apparent behavior. *American Journal of Psychology*, 57(2), pp. 243–259.

Skene, L. (2002). Ownership of human tissue and the law. *Nature Reviews Genetics*, *3*(2), p.145.

Vande Moere, A. & and Patel, S. (2009). The physical visualization of information: designing data sculptures in an educational context. *In Visual Information Communication*, Springer, pp. 1-23.

Authors Biographies

Dr. Howard Boland is a multidisciplinary practitioner working across art, science and technology. With a strong technical and innovative creative skills, his experience spans from artistic and scientific research contexts to leading projects and teams in the interactive industry. He is artistic director of the art-science organisation c-lab specialising in biological art. His PhD combined synthetic biology and art to produce novel visual expressions in bacteria culminating in the UK's first art exhibition featuring living genetically modified microorganisms at the Royal Institute of Great Britain. He has an extensive experience in the digital creative industry leading creative and technical teams to award-winning projects.

Dr. Julie Freeman translates complex processes and data from natural sources into kinetic sculptures, physical objects, images, sound compositions and animations. Her work explores the relationship between science and the natural world; questioning the use of technology in how we translate nature. A mix of computer scientist and artist, her focus is the investigation of data as an art material, using it to create work which reflects the human condition through the analysis and representation of live animal data. She often works collaboratively and experimentally with scientists. She is co-founder of Fine Acts which bridges human rights and art to instigate social change. She co-leads the Data as Culture art program at the Open Data Institute, is a TED senior fellow and a Nesta fellow.

Jaden J. A. Hastings' research hybridizes the fields of biology (tissue engineering, genomics), informatics (machine learning), and New Media arts practice. She is an alumna of New York University, Harvard University, and the University of Oxford with advanced degrees in both Biology and Bioinformatics. Presently, she is a PhD candidate at the University of Melbourne in Interdisciplinary Arts Practice on an Endeavour IPRS/APA scholarship. She is also Chief Scientist of the x0.lab research group and Artist-in-Residence within the Biofabrication Lab of St. Vincent's Hospital in Melbourne.

Scott Hessels is an American filmmaker, sculptor and media artist based in Hong Kong. His artworks span different media including film, video, online, music, broadcast, print, kinetic sculpture, and performance. His films have shown internationally and his new media installations have been presented in museum exhibitions focusing on technology as well as those presenting fine arts. His recognitions include patents for developed technologies, references in books and periodicals on new media art, and coverage in cultural media. He is currently an associate professor at The School of Creative Media and executive producer of the Extreme Environments Program which organizes art/science expeditions to environmentally significant sites.

Tobias Klein works in the fields of Architecture, Art, Design and interactive Media Installation. His work generates a syncretism of contemporary CAD/CAM technologies with site and culturally specific design narratives, intuitive non-linear design processes, and historical cultural references. Before joining City University Hong Kong in the role as interdisciplinary Assistant Professor in the School of Creative Media and the architectural department, he was employed at the Architectural Association and the Royal College of Art. The resulting works of his studio are exhibited international with examples being in the permanent collection of the Antwerp Fashion Museum, the London Science Museum, the V&A, the Bellevue Arts Museum, Museum of Moscow and Vancouver.

CURRICULUM IN THE CRACKS: ENCOURAGING CROSS-DISICPLINARY AND ART-SCIENCE-HUMANITIES TEACHING

Panel Discussion
Topic Area: In Between the Cracks

Moderator: Roger Malina, Executive Editor Leonardo and Professor, School of Arts, Technology and Emerging Communication (ATEC) at the University of Texas at Dallas (UTD)

Panelist #1t (in person): Kathryn Evans, Senior Lecturer in Music, UTD School of Arts an Humanities; Project lead, CDASH

Pnaelist #2 (n person): Haytham Nawar,Assistant Professor and Director of the Graphic Design program, Department of the Arts at the American University in Cairo, and director of the Cairotronica

Panelist #3 (in person or via Skype): Cassini Nazir, Clnical Associate Professor in ATEC, Director of Design and Research, ArtSciLab, University of Texas at Dallas

Invitations have been extended to the following members of the Cloud Curriculum Working Group (some members may appear through SKYPE). Potential participants are members of the "Cloud Curriculum Working Group"

Faculty:
Eun Ah Lee, University of Texas at Dallas
Paul Thomas, University of New South Wales
Robert Root-Bernstein, University of Michigan
Annick Bureaud, OLATS
Lucinda Presley, Innovation Collaborative liaison
Meredith Tromble, San Francisco Art Institute
Julia Buntaine, Rutgers University, EIC of SciArt Center & Magazine
Jane Prophet, Goldsmiths, University of London
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Graduate students:
Jaoa Silveira, Universidade Federal do Rio de Janeiro, Brazil
Alex Garcia-Topete, UTD
Yvan Tina, UTD and University of Aix-Marseille
Sharath Chandra, UTD

KEYWORDS
Art-science, curriculum, assessment, transdisciplinary, cloud, collaboration

INTRODUCTION

The CDASH (Curriculum Development in the Arts, Sciences and Humanities) website was established in 2012 by Kathryn Evans and Roger Malina as a both a resource for faculty who engaged in or were interested in engaging in art-science-humanities curriculum; and as a data collection point where these types of curriculum could be surveyed for innovation and sustainability. The site currently contains over 150 courses from all over the world. The results were analyzed in 2014 and published in LEA (Leonardo Electronic Abstracts). The CDASH website re-launched in the Fall of 2016 at cdash.atec.io/ with several new features that will facilitate contributions and the analysis of cross-disciplinary curriculum. The new site has created a Cloud Curriculum of syllabi and assessment tools and a Cloud Curriculum Working Group to contribute, analyze and develop these areas.

The impact of cross-disciplinary curriculum on student learning and creativity has not been studied in depth. This kind of curriculum often lives "in the cracks", between traditional disciplines and departments. This panel will discuss the following questions:

1. Are students who have taken cross-disciplinary art-science-humanities courses more accepting or interested or explorative of areas outside their majors? Are they more innovative? Can they think "outside the box'? Can they become members of the "creative class"?
2. How do you design assessment of these kinds of courses that gives equal weight to both (or many) disciplines? How can the current theories in the science of learning help create meaningful evaluation procedures?
3. Are there differences in collaborative art-science-humanities teaching and learning in different countries and educational systems?
4. What are the challenges that cross-disciplinary curriculum faces in the current educational environment?
5. What factors lead to sustainability and success of such courses and programs?
6. How can institutions of higher learning encourage art-science collaborations in both teaching and research?
7. How is art-science education structured in primary/secondary institutions and in informal education?

The Cloud Curriculum Working Group will begin discussing these issues and others at the formal launch of the CDASH website cdash.atec.io in early 2018. These issues will be discussed in advance of the panel discussion at ISEA in June of 2018 through a collaborative mechanism on the website. In addition, new data from the CDASH website will be presented, including courses of interest, level of collaboration, departments offering the courses and evidence of sustainability.

ABSTRACTS

Moderator: Transdisciplinary education navigating the tree of knowledge
In common parlance, scholars often talk about the 'tree of knowledge', a metaphor that is reflected in the way that institutions (such as universities, funding agencies, and assessment units) structure their organizations. Art-science-humanities education that seeks to bridge usefully between different disciplines often runs into many obstacles, both intellectual and institutional. In a tree of knowledge metaphor, the branches grow apart and don't reconnect. In addition art-science-humanities education draws on disciplinary, interdisciplinary, multidisciplinary and transdisciplinary methodologies; as a result it is often not useful to talk of 'best practices' that standardize methodologies, but rather of 'good practices that enable non-disciplinary approaches.

The CDASH cloud curriculum seeks to map the various pedagogical approaches being used by educators internationally, but also to help make the community of practice visible to itself. As an astrophysicist teaching in a school of art and technology, I have been labelled unqualified to teach in this area as I don't have a degree in art or in technology. Through the CDASH cloud curriculum project we hope to develop approaches in education that fit into an ecology of knowledge incompatible with institutions in a tree structure.

Panelist #2
The impact of cross-disciplinary curriculum on student learning and creativity in a global environment has not been studied in depth. The efficacy of a cloud curriculum for international cooperation in higher education, particularly between the West and Asia, will be discussed. A new Call for Curriculum will be issued in early 2018 to expand our knowledge base of collaborative learning environments in the arts, sciences and humanities. Preliminary results will be offered as well as implications for future policies and practice.

An additional concern is assessment and evaluation of these kinds of courses. Higher education has long been departmental in nature. However, in the 21st century, investigators are finding that there are often tools, information, resources and even points of view from other disciplines that can elucidate and even answer the problem they are studying. The introduction of cross-disciplinary course will go a long way to training our students in more creative and innovative thinking, but these courses also need to be assessed in such a way that both disciplines are valued. The integration of the arts into STEM, and the current STEM to STEAM movement, should be viewed more often as a "two-way street". Courses that blend arts and science and humanities should do so with a mutual and equal understanding of the benefits to both areas. The new CDASH 2.0 Curriculum Cloud will allow us to better understand the nature of these kinds of courses and if; in fact, mutual understanding between disciplines is taking place.

Panelist #2:

Establishing a cross-disciplinary learning environment in higher education systems, may face various challenges relating to one's culture and embedded personal opinions regarding one's learning experience, both as an educator and learner. Since education is a lifelong process based on exploration, one can argue that such process cannot be neatly tailored, or evenly distributed. However, one of the challenges of undertaking a boundary crossing approach lies in the extent to which educators from distinct backgrounds are willing to cooperate together. Departments are often comprised of educators, advisors, and professors all working towards the same goal, each carrying a baggage of knowledge that stems from the same branch. An interdisciplinary system would require educators to step out of their comfort zone, and create a personalized outline based on the exchange of diverse ideas. Similarly, another challenge would be the extent to which students are willing to acquire knowledge from different disciplines. Students who are defensive of their own ideas and learning expectations tend to block any potential exposure to different thoughts and hence creative solutions through merging different scopes of knowledge are not fostered. An economically stable environment, with a culture that encourages communication and interaction becomes a strict necessity when setting a cross disciplinary curriculum in order to bridge the methodologies, epistemologies, and practices of different disciplines and reach a mutual collaborative understanding.

Although often thought of as standing at the opposite ends of the spectrum, sciences and arts have always been statements of social change and two of the most powerful means of expression through which arguments are developed and minds are changed. Hence, I believe academic institutions should play an essential role to tap into the potential of combining both, outreaching the different members of a community (students, artists, and researchers) by encouraging partnerships and co-sponsorships with major art and design festivals. Consequently, spreading the necessary knowledge concerning the merge of art and science and encouraging individuals to utilize it as a tool for problem solving, social change, and most importantly, a tool through which they can acquire valuable transdisciplinary skills. A personal attempt at building on the aforementioned realization, would be founding the Cairotronica: Symposium of Electronic and New Media arts in Cairo in 2016. The event came into being, with the sole aim of spreading New Media Arts in Egypt and the Arab World, utilizing it as a tool through which artists can face existing social/cultural/political challenges, encouraging freedom of expression. The program included activities, exhibitions, talks, workshops and screenings by local, regional, and international artists as well as academics, and technology experts. The event served as an active learning environment where students, artists, and an entire audience came together to explore and understand the link between technology and art.

Panelist #3:

As the lead for the redesign of the CDASH website, I will address how we approached the conception of the CDASH digital platform in order to provide meaningful collaboration and opportunities for contributions, and how the field of information architecture informed the design of such a system. This will further our research into the best models for creation of an international working group process and how best to use the CDASH platform as a testing bed for such systems.

BIOGRAPHIES

Roger F. Malina is a space scientist and astronomer, with a specialty in extreme and ultraviolet astronomy, space instrumentation, and optics. He served as director of the Observatoire Astronomique de Marseille Provence and was NASA Principal Investigator for the Extreme Ultraviolet Satellite project at the University of California, Berkeley. He is also a publisher and editor in the new emerging research fields that connect the sciences and engineering to the arts, design, and humanities. Since 1982, he has served as Executive Editor of the Leonardo Publications at MIT Press. He founded and serves on the board of two nonprofits, ISAST in San Francisco and OLATS in Paris, which advocate and document the work of artists involved in contemporary science and technology. He is currently a Distinguished Professor of Art and Technology and Professor of Physics, at the University of Texas at Dallas and Directeur de Recherche for the CNRS in France. He founded the ArtSciLab in the ATEC program fall 2013.

Kathryn Evans, Ph.D., is a singer, conductor, director, producer, and researcher in arts and science. Dr. Evans was the Associate Dean for the Arts of the School of Arts and Humanities at The University of Texas at Dallas from 1995 to 2010. Dr. Evans holds M. A. degrees in Mathematics and in Music and a Ph.D. in Art and Technology, with an emphasis on arts education in the 21st century. She is a member of the Art-Sci Lab in the School of Arts,

Technology and Emerging Communication, under the direction of Dr. Roger Malina, conducting research in music and science education. Her doctoral dissertation " Does musical study enhance academic skills in undergraduate non-music majors?" studied skills transfer for music study to academic skills in STEM subjects. Her current project CDASH (Curriculum Development in Arts, Science, and Humanities) explores the current state of cross-disciplinary curriculum at the college and high school level. She is currently developing curriculum for a music and science minor at UT Dallas, including her course "Music, Science and Technology" which will serve as the core course for the minor.

Haytham Nawar is an artist, designer, and researcher who currently lives and works in Cairo. He is Assistant Professor and Director of the Graphic Design program, Department of the Arts at the American University in Cairo. He is the founder and director of the Cairotronica, Cairo Electronic, and New Media Arts Festival. Nawar received his Ph.D. from the Planetary Collegium, Center for Advanced Inquiry in Integrative Arts, School of Art and Media – University of Plymouth. He holds a Masters of Advanced Studies ZFH in Spatial Design, Institute of Design & Technology, Zurich University of the Arts, Switzerland and an MFA in New Media and BFA in Printmaking from the Faculty of Fine Arts, Cairo, Egypt. He is a Fulbright alumni. Since 1999, he has participated in several international exhibitions, biennales, and triennials, the latest of which was Venice Biennial in 2015. Nawar won awards and acquisitions nationally and internationally in Algeria, Bosnia and Herzegovina, China, Cyprus, Egypt, France, Greece, Germany, Italy, Japan, Lithuania, Portugal, Kuwait, Spain, South Africa, South Korea, Switzerland, Syria, UAE and the United States.

Cassini Nazir is a Clinical Associate Professor in the School of Arts, Technology, and Emerging Communication at The University of Texas at Dallas where he teaches classes in interaction design. He is also Director of Design and Research for the ArtSciLab, a transdisciplinary research lab helping the arts, science, and technology communities by pursuing initiatives of societal urgency and cultural timeliness. His interests include interaction design, user interface and user experience. Over the past 20 years, Cassini has designed print pieces, logos, websites, and interactive elements for mobile, tablet and desktop devices. Cassini holds an MFA from UT Dallas' Arts and Technology Program and bachelor's degrees in English literature and Economics.

ACKNOWLEDGEMENTS

The CDASH project is supported by the ArtSciLab in the School of Arts, Technology and Emerging Communication (ATEC) at the University of Texas at Dallas (UTD); and the UTD Center for Teaching and Learning.

Mediated Natures - Speculative Futures and Justice Panel, Parts I and II

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Keywords
Art and ecology, Capitalocene, Ecological justice, Electronic art, Embodiment, Empyre, Feminism, Speculative, Multispecies worlding, Queerness.

Abstract
The Mediated Natures - Speculative Futures and Justice panel (parts I and II) addresses the radical aesthetics of ecological arts practices, multispecies worldings, and possibilities for survival in this epoch many term the Capitalocene. Undoing modernity's binary of culture and nature— which masks the hierarchy of human, subhuman, and nonhuman, and which fuels the engines of capitalism and colonialism —is of critical importance. Thus aligning with nonhuman others in resistance, revolution, and recuperation [1], panelists describe how their projects attempt socio-political acts of worlding through creative arts practices that have ties to new media, feminism, environmental justice, agroecology, science fiction, and/or citizen science. Presentations fuse the political and the aesthetic and decenter the human in the more-than-human Capitalocene. Finally, panelists consider the ways that media, technology, and the speculative further, hinder or redefine one another when encountering nonhuman others.

Introduction

How can mediated natures help us come to terms with justice, solidarity, ethics, survival and radicality in the Capitalocene: the stakes, the costs and the possible futures for different ecologies and the humans that live amongst them? Capitalocene, a central term for this panel, challenges the problematic universalizing framework of the Anthropocene; the term decenters "anthropos" or humanity in general, and centers instead on regimes of power and wealth that exploit human labor and labor beyond-the-human. For Jason Moore and Donna Haraway, the Capitalocene begins in the early modern period, the beginning of the market system, and its resultant colonial violence on (and upheavals of) humans, plants, animals, entire ecologies. Moore recognizes capitalism as an entire way of organizing nature, "a planetary system of power, capital, and nature". Capitalism, to Moore, is a "world-ecology" with a specific history—occurring over the past 500 years—and perhaps, therefore, possible to overcome. [2]

But given that art so often contributes to regimes of capital, is it realistic to think there is potential for our work to contribute to its undoing? Drawing from TJ Demos' ideas for a radical eco-aesthetics that ties eco-arts practices to global issues of class, race, geography, and gender, we must consider strategies—speculative, embodied, mediated—that complicate the art-capital connection and thus recognize the interconnected issues at play in social and ecological practice. [3]

The following panelists address how mediated natures help or hinder multispecies resistance and revolution, and consider modes of speculative study, communication and response with our nonhuman kin.

Our proposal arises out of the October 2017 [-empyre-] listserv discussion entitled *Radical Aesthetics of Multispecies Worlding, Eco-Art, and Solidarity in a More-than-human Capitalocene*, hosted by Margaretha Haughwout, with Grisha Coleman, Meredith Drum and Tyler Fox as discussants. Link: http://lists.cofa.unsw.edu.au/pipermail/empyre/2017-October/date.html

We propose a two-part panel, as many artists are eager to participate.

Part I Discussant Abstracts

Part I will include 15-minute presentations by five discussants. Moderated by Meredith Drum (Arizona State University), discussants include: Elaine Gan (University of Southern California); Heidi Boisvert (New York City College of Technology); Margaretha Haughwout, (Colgate University); Tyler Fox (University of Washington); and Rachel Stevens (Hunter College).

Fig 1. *Mycorrhiza form in encounters between trees, fungi, and brown coal* (Søby Brunkulslejer, Denmark), 2015, Elaine Gan and Anna Tsing, field photograph, © Gan and Tsing.

Elaine Gan
To acknowledge the Anthropocene as a geological epoch marked by human domination and planetary ruin is to put into question the work of art — its subjects, forms, and practices. When individual freedom and creative innovation (keystones of artistic life) fuel environmental degradation, we need ways of sensing, knowing, and living otherwise. This paper calls for attunement to more-than-human worlding, or the entanglements that emerge when species meet. I describe an art-science collaboration that follows fungi in former coal mining beds in Denmark (Fig 1). Histories and temporalities of naturecultures are embodied in the rhizosphere, an underground world of mycorrhizal encounters between fungi, tree roots, and brown coal. Anthropogenic disturbances of war and industry gave rise to the area. But abandoned in the 1970s then privatized, the area is now visibly dominated by fungi and trees. Digging into brown coal overburden, we began tracking and documenting mycorrhiza, the material forms of symbiotic encounters between species that mediate succession. The mycorrhiza reorient our perspectives, demanding that we follow their durations, cycles, senses, and scales, if we are to work with them. Who is mediating whom? Human and nonhuman, individual and collective, local and global are recomposed, queering the ontoepistemological foundations of modernist ethics and politics.

Heidi Boisvert
Heidi Boisvert will examine how biomimicry can be used as an artistic strategy to de-center the human and offer an antidote to the current post-biological technocracy fueled by the alienating forces of our current Cybernetic Renaissance. The various case studies and theoretical argument will attempt to forward an alternative technological paradigm, one which highlights "embodied differentials;" the intricate co-existence of and relationships between bodies, the environment, social contexts, and complex practices that foreground unpredictability, emergence and interdependence in an attempt to resist the predominant fear-based systems of social control, prediction and quantification. She will discuss three collaborative works: *Beware of the Dandelions*, a multi-media performance, that teaches social justice movement building through complex science, speculative fiction and hip hop; *Bioprosthesis*, an interactive installation which sonifies vital processes in trees to attune visitors and care-givers to the needs of organisms within the delicate eco-system of an arboretum; and *Possibilities in Disguise* (work-in-progress), an immersive experience which examines how particle physics behavior parallels epigenetic changes in the biological self through an embodied, bio-adaptive game that suspends the players lived bodies in energy and matter through sonic vibrations and projection mapping inside an architectural recreation of the Large Hadron Collider.

Margaretha Haughwout
Margaretha Haughwout argues that whole systems design strategies, while problematically emerging from the second wave of cybernetics, still might complicate the ease with which capitalism totalizes and thus disregards ecological difference.

Fig 2. *Guerilla Grafters How-to Highlights*, 2017, Margaretha Haughwout, Illustration, © Margaretha Haughwout.

By collapsing the binary between nature and culture, and by routing outputs back into inputs (feedback loops), coalitions including companion species, artists, activists and neighbors can generate sites of abundance that undo regimes of scarcity and of property. These ideas will be developed through a selection of Haughwout's projects, including the *Guerrilla Grafters* (Fig 2), Hayes Valley Farm and *Trees of Tomorrow*, which draw inspiration from whole systems cultivation strategies, but which also resist totalizing views of control that often accompany cybernetics and systems design.

Rachel Stevens
Infrastructure, Waterways and Alien Others: Technologies of Collaboration through Contamination is a research, mapping and video project examining the interstitial zone articulated by man-made infrastructure technologies in the St. Lawrence River at the border between Canada (at Quebec and Ontario), the United States (at New York State) and the Akwesasne / St. Regis Mohawk reservation (which spans the international border). Infrastructure projects such as the St. Lawrence Seaway Eisenhower shipping lock, the Moses-Saunders power dam, the international border itself and local industries (one, now a super-fund site) have altered the landscape and ecology of the region materially, socially, politically and economically. Through archival research, conversations with locals, empirical observation and testimony from the Akwesasne Mohawk, the project seeks to build a perspective on this site that shifts away from the traditional narrative of industrial progress—one that supports globalist and nationalist interests and champions a smooth flow of capital—and toward a tracing of unintentional ecologies, accidental collaborations with 'aliens' and various assemblages and lines of flight including, but not exclusive to, orchid species from other regions that have appeared here, 'invasive' species such as Asian carp, and immigrants, travelers and traffickers moving across and through. What one considers to be contamination is another's productive collaboration (Anna Tsing). The research is conducted in tandem with a

photography collaboration with media artist Gebhard Sengmüller that bares witness to how the land is marked and shaped by these infrastructure projects and the various negotiations that enabled them and that continue to transpire.

Tyler Fox

Tyler Fox will discuss the speculative project *Biolesce*, a series of interactive installations and sculptures featuring the expressive potential of bioluminescent algae. *Pyrocystis fusiformis* is a single-celled, non-motile, ocean-dwelling dinoflagellate that expresses a flash of blue light when physically agitated. Through biosensors (heartbeat sensor, GSR sensor, etc.), motors, and microcontrollers, the work places human and nonhuman embodied experience alongside one another. This shared experience between human and algae is mediated and enabled via technology. In this case, technology enables new a form of mediated experience, but one that is still, to some extent, 'natural.' He argues that technical mediation offers avenues of creative engagement with nonhuman physico-biological phenomena. Fox will discuss these avenues of engagement as a kind of actualized speculation, and will conclude with a discussion of how such activities challenge and reify different forms of anthro- and capitol- centricity.

Part II Discussant Abstracts

Part II will include 15-minute presentations by four discussants. Moderated by Margaretha Haughwout, (Colgate University), discussants include: Cesar & Lois (Universidade Federal do Ceará and Cal State University San Marcos); Grisha Coleman (Arizona State University); Meredith Drum (Arizona State University); and Simone Paterson (Virginia Tech).

Fig 3. *Readout of @HelloFungus twitter feed*, 2017, Cesar & Lois, hacked thermal printer with bot-driven tweets printed on receipt paper roll, © Cesar & Lois.

Cesar & Lois

Cesar & Lois are working with the fungal colonization of human knowledge systems through the merging of fungal networks and Internet-based communications. This has manifested as fungal growth over the text of physical books, with degenerative readouts tweeted by fungi as it grows (Fig 3). In a reversal of typical planetary dynamics, the fungal network overtakes the human system. The cultivation of this project precipitated Cesar & Lois' idea for their current endeavor: the collective development and support of an [ECO]cyrptocurrency. Cesar & Lois posit a nature-based economy, which relies on an autonomous system comprised of typically competing cultures, one culture derived from humanity and the other from nature. In this entirely atypical economic system, the artists strive to work together – across species and across networks. The end result is a "bhiobrid" (bio technology hybrid) blockchain that posits a nature-based cryptocurrency. Cesar & Lois are building the basis for a functional [ECO]nomy and, crucially, working to ground this system in principles that allow one to imagine the potential for a living currency to disrupt current economic models. The artists are experimenting with growing natural networks that can also intersect with the Internet and human-based technological networks in order to rethink the values assignment system advanced in the Capitalocene. This cross-species work has antecedents in LOIS' art projects with human-plant interactions and in Cesar Baio's deviating networks. As artists/theorists and bio enthusiasts the collective wants to involve discussants in the fields of economy, global finance, systems engineering, and cultural theory about the implications of such a hybrid apparatus for inserting nature into economic transactions.

Grisha Coleman

Coleman's talk will focus on her arts-driven research and production project, *echo::system*, a large-scale, ongoing, collaborative framework for examining the intersections of art, environmental sciences, technology, performance, and public engagement. *echo::system* can be framed as a springboard for re-imagining the environment, environmental change, and environmental justice—collaboratively developed with an interdisciplinary team of dancers, musicians, researchers, scientists, architects, and media artists. Coming from the world of dance and live art, and working amongst technologist, this work emphasizes the proposition that the physical intelligence of the body, when explicitly included in an information delivery loop as an interlocutor of presence and experience, can intervene positively in conventional dichotomies of quantitative/qualitative thought.

Meredith Drum

Drum will discuss her *Oyster City Project* (co-created with Rachel Stevens), a collaborative that attends to bioremediation and environmental justice along New York City's shoreline—where more-than-human terrestrial and aquatic systems meet. Mediating nature with both high and low technology, the artists experiment with forms of public and political art while centering on urban citizens' health—

human and nonhuman—above and below the water's surface. *Oyster City AR* (Fig. 4 + 5) is a situated and distributed documentary that evaluates the construction, by NGOs and government organizations alike, of oyster reefs made with the aim to bioremediate NYC's harbor. With a spirit of détournement, the artists built the app using a hi-fi mobile media augmented reality platform (developed by Phoenix Toews), using the tech to reverse the norm, to push through the mobile lens and out to bodies in space, bodies in relation. Recognizing that their app suffered from its dependence on expensive technology, the artists next created the lo-fi, spiral-bound *Fish Stories Community Cookbook* (2015), a collection of recipes, stories, drawing and ecological information contributed by people who live and work in NYC's Lower East Side. The book celebrates the practice of sustenance fishing as a non-binary natureculture entanglement. With these initiatives, the artists add to voices demanding that governments collect larger taxes and fines from polluting industries to pay for environmental cleanup.

Fig 4. *Oyster City AR*, 2013, Meredith Drum and Rachel Stevens, augmented reality app, © Drum and Stevens.

Simone Paterson

Our ability to die, defines, in part, our humanity. Artificial intelligence or other digital entities have the potential to live forever. These immortal objects/ beings are reliant on technology, so too is the artwork for *disEase*, (Fig 6) a body of work that reminds us of our mortality. We are visually warned of unseen threats to our existence; the microscopic world of pathogens viruses, bacteria, fungi and parasites. Using computerized machine embroidery, the minuscule threats to humanity, and the sometime fatal interaction between animal and humans are visualized. 2D/3D Animation and motion graphics are used to inform the public about the methods of disease transmission. The range of contrasting art-making techniques of needle work and digital imaging is a deliberate strategy to blur boundaries because technologies are more than just tools, they affect who we are and change the way we think as well as our relationship with others. I am interested in the influence of technology, on bodies and minds, and the possibilities of a transfigured consciousness and an embodied experience via the production and deconstruction of new media art. This method of working could be classified as "post new media" i.e. a collision or coalescence between traditional and new media techniques as well as suggesting a new materiality. Finally, I see the screen as a permeable membrane where ideas flow in and out and through, as a way to corrupt or transcend the limited myth of the "artist" and establish a feminist visual vocabulary as a way to acknowledge the historically unpaid labor of women.

References

1. Deborah Bird Rose, *Reports From a Wild Country: Ethics for Decolonization* (Sidney: University of New South Wales Press, 2004).
2. *Anthropocene or Capitalocene? Nature, History, and the Crisis of Capitalism,* ed. Jason W. Moore (Oakland: PM Press, 2016).
3. T.J. Demos, *Decolonizing Nature: Contemporary Art and the Politics of Ecology.* Berlin (Berlin: Sternberg Press, 2016).

Bibliography

Demos, T.J., *Decolonizing Nature: Contemporary Art and the Politics of Ecology*. Berlin: Sternberg Press, 2016.

Haraway, Donna. *When Species Meet*. Minneapolis: University of Minnesota Press, 2008.

Moore, Jason W., ed. *Anthropocene or Capitalocene? Nature History, and the Crisis of Capitalism*. Oakland: PM Press, 2016.

Rose, Deborah Bird. *Reports from a Wild Country: Ethics for Decolonization.* Sidney: University of New South Wales Press, 2004.

Tsing, Anna. *The Mushroom at the End of the World: On the possibility of life in capitalist ruins.* New Jersey: Princeton University Press, 2015.

Authors' Biographies (Parts I and II)

Cesar & Lois ponder autonomous systems that integrate natural and technological networks. In their various bodies of work, Cesar Baio subverts the algorithms of autonomous systems, while LOIS infuses art with nature's data. Together they create fungal systems that tweet and posit nature-based economies. LOIS co-founder Lucy HG Solomon is assistant professor of media design at Cal State University San Marcos, where she focuses on digital intermediaries of and ensuing interactions with nature. Cesar Baio is a visiting researcher at i-DAT in the U.K. and associate professor at Universidade Federal do Ceará in Brazil. His interests lie in the relationship between art, technology and society. In the construction of interactive object-based experiences, LOIS strives to elicit discordant feelings of reverence and irreverence. Disruptive systems by Cesar Baio and responsive art by LOIS exhibit globally; their @HelloFungus twitter feed was on display at Ravenna Art Museum in Italy last December.

Elaine Gan studies multispecies interactions, particularly in rice agriculture, and how they shape geopolitical histories. She is a Mellon Fellow in Digital Humanities, affiliated with the departments of Anthropology and Media Arts + Practice, at University of Southern California. She has also been a

member and art director of Aarhus University Research on the Anthropocene (AURA) in Denmark since 2013. Past fellowships include the New York Foundation for the Arts, Whitney Museum Independent Study Program, and Lower Manhattan Cultural Council. Recent projects include co-editing an anthology titled *Arts of Living on a Damaged Planet: Ghosts and Monsters of the Anthropocene* (Minnesota Press 2017); convening a seminar series on feral technologies for Haus Kulturen der Welt (HKW Berlin 2016); and co-curating an exhibition titled *DUMP! Multispecies Making and Unmaking* (Kunsthal Aarhus 2015).

Grisha Coleman works as a choreographer and composer in performance and experiential media. Her work explores relationships between our physiological, technological and ecological systems. She currently holds the position of Associate Professor of Movement, Computation and Digital Media in the School of Arts, Media and Engineering, and the School of Dance at Arizona State University. Her recent art and scholarly work, *echo::system*, is a springboard for re-imagining the environment, environmental change, and environmental justice. Coleman is a New York City native with an M.F.A. in Composition and Integrated Media from the California Institute of the Arts. Her work has been recognized nationally and internationally; including a 2012 National Endowment Arts in Media Grant [NEA], the 2014 Mohr Visiting Artist at Stanford University, a fellowship at the STUDIO for Creative Inquiry at Carnegie Mellon University, and grants from the Rockefeller M.A.P Fund, The Surdna Foundation, and The Creative Capital Foundation.

Heidi Boisvert creates groundbreaking games, web interactive, augmented reality and transmedia storytelling experiences for social change, as well as large-scale networked performances in dance and theatre using bio-creative technology. She co-founded XTH, a company creating novel modes of expression through technology and the human body. She has been a Harvestworks Fellow with support by the Rockefeller Foundation whose works have been featured in Kotaku, TIME, Wired, Salon, Fast Company, Washington Post, and the Atlantic, and showcased at EMPAC, Banff New Media Institute, Queens Museum, Kunsthalle and the Waag Society. Heidi received her Ph.D. in Electronic Arts from Rensselaer Polytechnic Institute. She is currently the Director of Emerging Media Technology at New York City College of Technology (CUNY) and a research affiliate at MIT OpenDoc Lab.

Margaretha Haughwout's personal and collaborative artwork explores the intersections between ideas of technology and wilderness, digital networks and the urban commons, cybernetics and whole systems permaculture — in the context of ecological, technological and human survival. Her active collaborations include the *Guerrilla Grafters*: an art/ activist group who graft fruit bearing branches onto non-fruit bearing, ornamental fruit trees, and the *Coastal Reading Group*: consisting of artists from different coasts who trouble the subjects of wilderness, speciation, humanness and ways of knowing through diverse engagements with (non) humans. Haughwout and her collaborators at Hayes Valley Farm, an interim-use urban permaculture farm in downtown San Francisco, cultivated low input ecological systems and developed a unique lateral governance structure that was able to engage a range of different kinds of human input while still navigating complex politics with city agencies. Haughwout received her MFA from the University of California Santa Cruz.

Fig 5. *The Oyster City Project* studio space in LMCC's Building 110, Governors Island, 2013, Meredith Drum and Rachel Stevens, photograph, © Rachel Stevens.

Meredith Drum is an experimental cinema-maker; in addition to her screen work she collaborates with other visual artists as well as dancers, musicians, architects, writers, urban planners, computer programmers and scientists on location-based public projects, movement research, augmented reality apps and books. As Drum employs electronic media, she turns a critical eye on the commercial world of digital objects and experiences, and critiques these as part of a larger capitalist system that obfuscates pathways of access, connection and resistance. She sets out to re-shape icons and patterns, which typically separate us from other people, animals, plants and landscapes, in order to open more compassionate technical imaginaries. Her work has been supported by grants and residencies from the Lower Manhattan Cultural Council, iLand, the Bronx Museum of the Arts, the Experimental Television Center, Wave Farm, ISSUE Project Room and other institutions. She is an assistant professor at Arizona State University.

Rachel Stevens is an interdisciplinary artist and researcher based in NYC. Her work engages socio-material systems, ecologies, moving images and archives. She was recently invited to participate in the NEH Summer Research Institute on Space, Place and the Humanities at Northeastern University. Other recent projects include a year-long residency with iLAND and, as the collaboration *Oyster City*, a public project commissioned for Paths to Pier 42 in Lower Manhattan. Stevens has presented work at Socrates Sculpture Park, ISEA, i-Docs and Visible Evidence among others. She writes about art and visual culture, is an Associate Editor at *Millennium Film Journal* and belongs to the curatorial collective Two Chairs. She teaches in the Hunter College IMA MFA program in NYC.

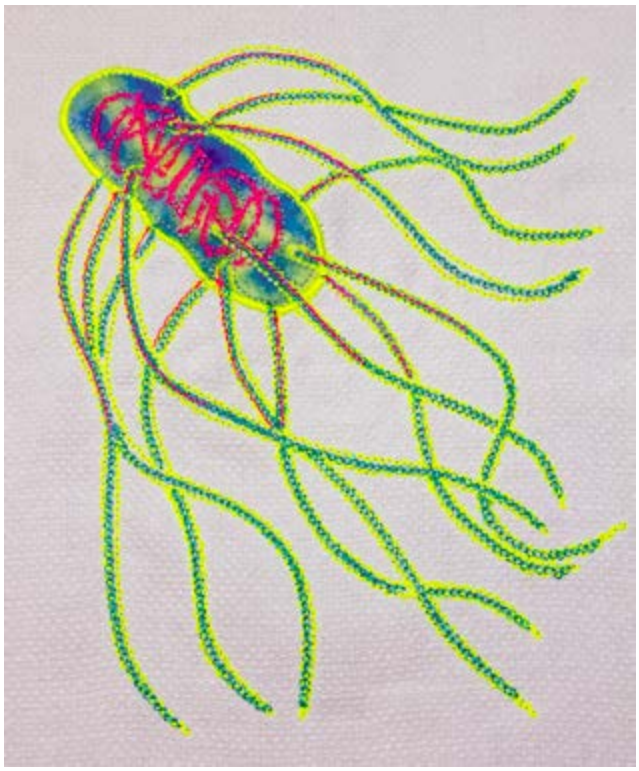

Fig 6. *Salmonella* (detail) 2018, Simone Paterson, computerized machine embroidery on vintage linen, © Simone Peterson.

Simone Paterson is an artist who works at the crossroads of creative technologies and craft. Her current work examines notions of hygiene, and infection via the lens of "women's labor", namely embroidery. As an immigrant living in the "new" Trump America she is concerned with the aesthetic possibilities of technology and also the impact of technology on lived experience. Her installations with diverse applications of technology have been exhibited worldwide, including Artspace, Richmond V.A., and a residency at Art Space, Sydney, Australia. Paterson is a National Member of A.I.R Gallery, Brooklyn, New York. She received her MFA from Sydney College of the Arts, Sydney University, and a Ph.D. from The University of Newcastle, New South Wales, Australia. She is Associate Professor and Chair of Undergraduate Studies in Creative Technologies, the School of Visual Arts, and a member of the Executive Committee of Human Centered Design graduate program at Virginia Tech.

Tyler Fox is an artist, researcher, technologist, and educator. His work focuses on the ways in which nonhuman relations shape our experience of, and relationship to, the surrounding world. He leverages technology to create affectively-rich experiences featuring living, nonhuman organisms. His writing mobilizes philosophy and contemporary theory to consider the aesthetic potential of technology and nonhuman experience. Fox received his MFA from the University of Auckland, and his PhD from the School of Interactive Arts & Technology, at Simon Fraser University. He is a lecturer in Human Centered Design and Engineering at the University of Washington.

Impact of Social Art in the People´s Smart Sculpture PS2

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Abstract

The People´s Smart Sculpture PS2[1] panel of ISEA2018 in Durban reflects the social and political impact of a 4 years media art and science activity in Europe with more than 800 artists and scientists involved. PS2 developed participatory digital art methods for changes in urban living environment. What will be left after 4 years? Which results, artistic methods, digital tools will sustain? What is transferable into different situations? The panel additionally integrates the experiences of the temporary African-European PS2 digital art lab in June, before and during ISEA2018 in Durban.

Keywords

#Social Art #Social Resonance #Impact of Media Art #Participative Art #Urban Re-Design #Urban Art #Digital Art #Changes in Europe #Impact Lab #Digitalization #Durban Art Lab

Introduction

Today we witness a large societal shift that is driven by the digitalization, urbanization, new forms of labor, climate change and globalization. Especially the urban sphere of the cities undergo a change in the perspective: What determines the cultural development? Who is responsible for the social infrastructure? Who is eligible for education and integration in a city? What are the new ways of expressing ideas and contributions towards a good and livable urban environment? How are we designing the social through digital art?

The People's Smart Sculpture PS2[2] is a 4-year creative research and art innovation project, co-funded by Creative Europe [3]. PS2 fosters participative art, urban development, and digital culture processes in city spaces. It clusters smart participation activities from all over Europe and designs new art forms, digital strategies, art as methodologies and digital media tools that allows new perspectives and approaches towards urban re-design and the participative cultural evolution of urban spaces. PS2 tries to find answers over the use of social art to create a better social resonance and participation in urban re-design and society. Did we succeed? Can we adapt our artistic methods to future demands? The project is about cultural construction of future spaces by real people as performative spaces. The PS2 approach works on two levels: The employment of new artistic methodologies and digital tools for participatory urban re-design that is tested on site and in everyday life situations. And the evaluation of those activities in a comparative analysis under the aspect of real transferability to other places.

This panel discusses the failures and achievements of PS2, its artistic activities, labs and tools as well as the sustainable results in their interdependency with local dimensions and agoras but also aspects of real transferability into different realms and the social and political impact. Can our digital art support the emancipation of human beings?

The Spectre of a Smart Art City

A spectre is haunting Europe - the spectre of a Smart City. It has passed more than half a century after Charles Percy Snow (The two Cultures, 1956) wrote his thesis to the two opposing cultures. Meanwhile, with the digital media R&D in ICT and actual cultural development of the last decades, a not inconsiderable part of the computer science contributes to re-connecting the existing scheme of the scientific-technical areas on the one hand and of the social-artistic-cultural on the other. This applied in particular to an almost infinite number of digital media, digital art, and digital culture projects. While the footprint of algorithms can be found at the latest since the information technology penetration of all work areas of future city development, the spectre of a diremption or disintegration between a technological economy for smart cities and people´s free will to design smart cities and live in these environments appear. A new critique is needed towards a technical economy whose algorithms can support people in their daily lives but also create a non-official, not well recognized back-

ground policy – very potent and effective but not democratically adopted. But: digitalization is nothing new for those who work in their expert field of urban development as urban planners, designers, architects, district associations, network companies, energy providers or scientists. They all use digital expert tools and citizens use at least social media and other digital tools in their communication and self-expression. But A) these are all sectoral systems and B) there is no new agora that connects the experts and the citizens for to create a new overview and a new forming of the political will.

A sustainable smart city development through digital art should include participation, green sustainability, should contribute to social balance, job creation, a better life and the happyness of people. A simple but strong idea was given by Caragliu et al. (2009): "We believe a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance." [4] But how to support such an integrative smart city – smart humans approach in this phase of digitalization? No citizen is against busses that arrive in time, or against a more efficient heating or energy management system, but what if an algorithm, so to say "decides", about the spectrum of your choices or about the medium people are allowed to use for to express themselves in context of participating in the urban development? What if also the political class don´t know what the algorithms cause? What if political power is transferred to a technique instead of to enable people to bring themselves in, into the sphere of smart city development? How can we create a higher level of democratization while we realize smart cities instead of possibly decreasing it?

Synæstetic Social-Technical Utopia

It is required to access the full potential of the new capabilities of communication networks, the broad availability of microcomputers, new design and especially young people´s e-skills to enable people to participate in a smart city context. To increase the engagement of citizens in their urban surrounding, to foster identification with the cities they live in, can lead to social development, innovation development, democratization and in the end also to more employment and social balance. Participation has to become part of every city initiative today. This cannot be done just by creating new technologies. But it can be done better by using methods of art that help to involve also groups of citizens that are mostly left out of today's urban decision making.
The panel discussion tries to verify that the integration of digital art tools in urban decision making processes can help to realize a new smart participation as a possibly necessary cultural technique in Europe's city spaces and how it creates a new social inclusion. In this part of the panel we will present perspectives on emerging technologies like VR/AR, AI and how they can be used to create artistic expression. We will argue that digital technology is not good or bad per se but needs to be considered in a proper contextual setting for not to support the unsocial aspects in life. Adapting emerging technologies for artistic expressions might bridge the gap between artist and audience and help to better convey the artistic message thus providing new ways of participative development. But what happens when artists, technical specialists and cultural experts apply disruptive technologies to change the public space and fail in supporting democratic participative actions but become a "social weapon"?

Enable Yourself

The PS2 approach blends different levels of access: public participation, collaborative creativity, exploratory- and game-based learning about to change your neighbourhood. It integrates digital art, design thinking, science, smart technologies and user culture and motivates a broad dissemination of new skills, design expertise, informal learning and social knowledge. These fields are referred as key to improve broad educational effects, while picking up widely spread social dynamics and meet, as McLoughlin and Lee (2008) have lined out, "the needs of a generation of learners who seek greater autonomy and connectivity as well as opportunities for socio-experimental learning" [5]. This also contains the idea of the urban environment as communication space between all: citizens, government and other stakeholders. This means in the context of the need of a highly sustainable cultural development strategy to integrate opinion sharing, digital cross-cultural social inclusion, distinct communication of ideas, performative communication acts, new cultural expressions and explorative and informal learning capacities. The skills, which will be implicitly developed by people while utilizing in the participative art activities can be leveraged as skills for creative expression and social empowerment of participants and their own communities expressing local issues and desires like it several PS2 labs. This might be the base for a new deal between artists, experts, citizens, learners, creators and the government. It is a performative integrated art to combine social and cultural sustainability in the city.
On the educational level it can help to improve a large set of important future skills and techniques in handling media and ICT, like 3D-modelling and programming, AR, VR. Skills developed through things like online games and social media use during leisure time as entertainment can be leveraged as skills for creative expression and social empowerment embedded in and serving local issues and desires. Social skills are mostly gained "along the way" by learning and applying new strategies of collaboration and participation, and by using non-professional expertise. A good example for that can be found in the PS2 urban redesign contest in summer 2016, where stakeholders from all society levels, ages and professional backgrounds came together to debate about urban development and to share their technical and social knowledge about the topic. Additionally theorizing about and experimenting with urban

development provides strategical knowledge about transformational processes and societal changes. Being aware of future topics like smart cities, use of new smart technologies and strategies for urban development is of great importance, considering that according to the UN World Urbanization Prospects of 2014 „by 2050, 66 per cent of the world's population is projected to be urban"[6].

PS2 Labs in Europe

PS2 labs [7] for peoples participation: gamelabs, social impact labs, virtual urban art labs, digital performance labs – some of them were realized as temporary labs and some as durable ones. This part of the panel will discuss the design, offers, uses and impact of the different PS2 labs. Three labs will be presented in detail here: The 4D lab, a temporary lab in an overseas container and the digital urban impact lab in Bremen. The Bremen lab is a digitally supported creative, participatory, thinking and action space, which is used as a source for integrative and social urban district development in the less developed West of Bremen and sees itself as a service provider for the district, its people and institutions.

The concept of the lab – art as service – relies on digitization as an enhancer of social participation and aims to explore the connection between digital culture (eg, through the transformation of digital tacid knowledge) and experimental action (digital production, digitally-based self-organization, mapping, digital urban art, digital urban development) to transform competences that allow improved access to society, labor and education and develop the district in the process. In doing so, the lab responds to well-known deficits in Bremen's West, such as reduced participation in social life, neighborhood development, the digital gap and divide or increased youth unemployment.

How to increase equality of opportunity in the district via media art? By equipping the action spaces of people from disadvantaged groups such as refugees, early school leavers, young mothers, migrants, or the low-skilled in the sense of an enabling digital art didactics with important skills for the future - by the digital culture – the lab directly contribute to improving the social and economic equality of opportunity in the district and developing new societal and social resonance spaces. But how sustainable are the effects of the lab? Does it create effects on the political level as well?

PS2 Durban Lab

Imagine the inner city of Durban as a special place to love, live, and work, the temporary PS2 lab in Durban, run by Southafrican and Europan artists and scietists analyzes existing district culture, picks it up and act as an attractor for the growing artists, maker, commoning and digital scene by highlighting local strengths, advantages and disadvantages by creative and young artists and cultural innovators. The meeting of local citizens with these innovators in the lab in public space can contribute to freeing up new energies for cultural projects.

The lab implements an inter-institutional cooperation of a high diversity of local actors, by complementing the existing options with digital art methods and tools and offering new expression possibilities. The lab can build a bridge between existing initiatives, African and European artists. Workshops about tool-building, artistic methods, participation and art project fundraising will be implemented as well as daily participative art activities. The panel will discuss effects, opinions and results of the work with and in this temporary digital art lab.

Acknowledgements

The People's Smart Sculpture PS2, is co-funded by Creative Europe between October 2014 and Augusts 2018.

References

The People's Smart Sculpture PS2 on the www: http://smartsculpture.eu

The People's Smart Sculpture PS2 on Facebook https://www.facebook.com/ThePeoplesSmartSculpture/

Creative Europe, European Commission, Education, Audiovisual and Culture Executive Agency: https://eacea.ec.europa.eu/creative-europe_en

Caragliu, A., Del Bo, C., Nijkamp, P. (2009). *Smart Cities in Europe*. Proceedings of the 3rd Central European Conference in Regional Science, Košice, Slovak Republic 7-9 October 2009, 45-59.

McLoughlin, C. Lee, M. (2008). Future learning landscapes: Transforming pedagogy through social software. Innovate 4(5), p.3.

United Nations, Department of Economic and Social Affairs, Population Division (2015). *World Urbanization Prospects: The 2014 Revision, (ST/ESA/SER.A/366)*. https://esa.un.org/unpd/wup/Publications/Files/WUP2014-Report.pdf. Accessed 12 July 2016.

PS2 labs:
https://www.facebook.com/ThePeoplesSmartSculpture/
http://impact-lab.eu
http://www.smartsculpture.dk
http://www.public-urban-lab.de
https://www.offenbach.de/wirtschaft/kreativwirtschaft/luminale_/index.php
http://www.ps2.mk/index.php/about/bitola
https://mirevi.medien.fh-duesseldorf.de/wp/peoples-smart-sculpture/trails-of-memory/
https://mobilegamelab.de
https://mirevi.medien.fh-duesseldorf.de/wp/peoples-smart-sculpture/making-things-tell/
http://www.metropolia.fi/en/research-development-and-innovation/all-projects/the-peoples-smart-sculpture/
https://brokenships.com
http://smartsculpture.eu/zagreb-upper-town-change-of-heart/
http://smartsculpture.eu/children-s-city-tapestry/
http://smartsculpture.eu/move-into-the-open-space/

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ECOLOGICAL AESTHETICS
artful tactics for humans, nature, and politics

image above: Milwaukee's Overpass Light Brigade in action

Stories.

Stories that think and change; stories that deconstruct and distill; stories that make and provoke new stories, new pasts, presents, and potentials – all felt and thought, both affectively, and upon reflection.

My new book, *Ecological Aesthetics: artful tactics for humans, nature, and politics* (Dartmouth College Press, to be released 3 July 2018) reminds us that stories are simple, but precious – and, perhaps, a bit too rare in current critical discourses. And they are the "artful tactic" with which I propose we mostly orient ourselves towards concern with the world: with humans, nature, and politics, with how we move-think-feel and act. I give in-depth narratives around about ten artists and their artworks, over ten sections, like a gentle manifesto, moving between strong statement and rich description, thoughtful definitions and punctuated rhythms.

An "ecological approach" takes account of agents, processes, thoughts, and relations. Humans and non-humans, matter and concepts, things and not-yet things, politics, technology, economics, and industry, for example, are all actively shaped in, and as, their interrelation. And "aesthetics" is five things: what *can* be said, shown, experienced, or practiced; what *is* said, shown, experienced, or practiced; *how* it is said, shown, experienced, or practiced; *why* it is said, shown, experienced, or practiced; and, most importantly, the stakes therein. It is, overall, a *style* of, and *orientation* towards, thought, and thus action.

For ISEA, I am proposing a paper and roundtable / panel discussion with four of the artists / art collectives I write about in this forthcoming book, to explore new forms of media-based art activism, which have us encounter a politics of generosity and beauty in the everyday,

a Doung Anwar Jahangeer *City Walk*

through stories, friendships, protests, walks, and other relationship-forms that cultivate looking, seeing, feeling, acting, and change.

For example, Durban-based, Mauritian-born artist and architect Doung Anwar Jahangeer's failed attempt at suicide resulted in a new life of walking and talking, teaching and learning, between his habitat and communities. Inspired by Michel de Certeau's "Walking in the City" (1984b), Jahangeer continues this book's argument in showing us the difference between tactics and strategies, and the importance of vulnerability in the everyday. He takes interested parties on long walks around Zululand, and his politically charged but always generous artwork is literally an experience and practice of movement, a relation to others and their/our environments. Jahangeer points out what he calls the "organic intelligence" of cities, society, nature: emerging ecologies.

Or, former ISEA Co-Director Malcolm Levy makes prints and videos that are reminiscent of glitch art, which purposefully makes use of errors in media storage and/or playback formats as part of its aesthetic, most often inviting an experience of media's materiality, and/or our relationships to its concepts and forms. This artist's works present what happens when we accent how contemporary electronic sensors move and think and feel and *break*—at least in terms of what we have come to want and expect from today's consumer-based, "postinternet" technologies. Postinternet does not mean "after" the internet, but rather after its incorporation into the everyday: art and aesthetics that address the World Wide Web's (and broader contemporary

one of Malcolm Levy's *Other-frames*

technology's) effects on culture, society, and dialog. It is often talked about alongside the "new aesthetic," which refers to the increasing use of machine and digital ("new" media) images and forms in our physical and aesthetic world. Glitch, drone videos, augmented reality, surveillance, and GPS-generated maps and views are all examples of the new "born digital" aesthetic. Levy and his materials, processes, and images challenge the standard narratives we tell each other about computers—what they are, and do, and afford—and gift us with new ones, and thus new possibilities. Here we engage with Richard Grusin's "Radical Mediation" and Jussi Parikka's *Anthrobscene* to speculate on, wonder about, and move around those human constraints we thrust upon our machines, with microcontrol. What are their unseen impacts and ethical implications? Levy's *other-frames* bring to the fore the materiality of digital information, and images, and tools, and the inherent politics of how we make and relate to them.

The Overpass Light Brigade turns left-leaning Twitter sound bites into collaborative, physical messages that light up bridges for drivers and pedestrians to reflect on, or participate in. We will discuss how the team brings together individuals, each holding one lit-up alphanumeric character, to display changing activist messages on highways and at rallies. Theirs is a community of practice, a ripple effect of connections always a part of, and making, bodies, texts, meanings, policies, stories. This section pieces together Jean-Luc Nancy's being-with of matter and people and things, and simultaneously exhibits the ecological connections of many (and implicitly all) contemporary activist practices.

Finally, we will go on to contrast aesthetic versus ethical approaches to life and decision-making. South African-born and New York-based artist and teacher Sean Slemon produced *Goods for Me* (2011) and other tree-based works, where he pulls, breaks, or cuts down each of a tree's components—large and small leaves, various-sized branches, the trunk and roots—and compartmentalizes them into individual frames, like a cabinet of curiosities. These sculptural installations, which also house live bugs and ongoing decomposition, articulate nature and culture as continuously moving—and thus changing—together, and over varying timescales. Here we have an immediately felt experience—what Alfred North Whitehead calls "self-enjoyment" (1968: 150) and Eduardo Kohn calls an "aesthetic of the immediate" (2002: 70)—which also has us "concern" ourselves with the before and after, with the outside that both made for this occasion of experience, and where, with our help, it might be heading afterward (Whitehead 1968: 167). Overall, style and aesthetics, wonder and beauty, can have us think-with, and thus aim toward, a better future.

Sean Slemon's *Goods for Me*

The everyday notion of representation could mean "to depict," or "to present again" (re-present), but Jean-Luc Nancy asserts that the "re- of the word representation is not repetitive but intensive . . . mental or intellectual representation is not foremost a copy of the thing," but an intensified presentation. It is "a presence that is presented" (Nancy 2007: 36; emphasis in original). The re- in represent is, in other words, an amplification; to represent is to present more of what *is*. Thinking further still, re-presenting could refer to the potency in and of the present. Here we move-think-feel with our present, and all the things (actions, objects,

entities, and time itself) that led to this moment and encounter, all the things (conceptual, material, temporal, and otherwise) that might unfold from now. The present, and all that it is, is always more, is always present in its own fullness, and present as the things past and things to come; it can and should always be felt, both ecologically and aesthetically. To re-present in this way is to present our present (and more) as a presence.

Art does this. Stories do this. Things do this. *We* do this. We perceive and think-with, represent and influence, concern ourselves and act. And so representation, whether fictional or "true," physical or virtual, is aesthetic in the "how" of its more-ness; ecological via its "with"; and tactical in what it does. The artworks re-presented here engage with media and community, relationships and efficacy, local and universal forms of materialization and dialog. They both communicate and take on what ethical responsibility might mean in this, an age where hypocrisy is completely unavoidable, and ever-expanding power is granted to an ever-shrinking few.

Every aesthetic orientation is an ethical one, and vice versa. This panel is an experience and a practice, a call for experiences and practices, that takes account of aesthetics, ecologically (and ethically). And it ultimately asks us to do precisely this. Tell stories. Yours, each other's, the world's; tell stories of the things that matter.

Ecological Aesthetics (the book) and this panel are not about art – at least not exclusively. They ask us to continuously think- and act-with the world and its inhabitants, both human and nonhuman; to orient ourselves in ways that we might find and express what our environments, and what they are made of, want; and then to decisively help and continue those thoughts, wants, and actions along their way. More on the book project at http://ecologicalaesthetics.net; it's available via for pre-order Amazon at http://amzn.to/2lyREAk

Nathaniel Stern < http://nathanielstern.com **>**is an artist and writer, Fulbright and NSF grantee and professor, interventionist and public citizen. He has produced and collaborated on projects ranging from ecological, participatory, and online interventions, interactive, immersive, and mixed reality environments, to prints, sculptures, videos, performances, and hybrid forms. His first book, *Interactive Art and Embodiment: The Implicit Body as Performance* (Gylphi 2013), takes a close look at the stakes for interactive and digital art, and *Ecological Aesthetics: artful tactics for humans, nature, and politics* (Dartmouth 2018) is a creative and scholarly collection of stories about art, artists, and their materials, which argues that ecology, aesthetics, and ethics are inherently interconnected, and together act as the cornerstone for all contemporary arts practices."Technological, thought-provoking and unexpected" (*NPR*) Stern has been dubbed one of Milwaukee's "avant-garde" (*Journal Sentinel*), called "an interesting and prolific fixture" (*Artthrob*) behind many "multimedia experiments" (*Time.com*), "accessible and abstract simultaneously" (*Art and Electronic Media* web site), someone "with starry, starry eyes" (*Wired.com*) who "makes an obscene amount of work in an obscene amount of ways" (Bad at Sports) – both "bizarre and beautiful" (*Gizmodo*). According to Cory Doctorow at *Boing Boing,* Stern makes "beautiful, glitched out art-images," and Caleb A. Scharf at *Scientific American* says Stern's art is "tremendous fun," and "fascinating" in how it is "investigating the possibilities of human interaction and art." Stern is an Associate Professor of Art and Design in Peck School of the Arts at the University of Wisconsin – Milwaukee, and a Research Associate at the Research Centre, Faculty of Art, Design and Architecture, University of Johannesburg.

Other panelist web sites:
http://www.dala.org.za/dala_doung.html
http://transfergallery.com/other-frames-malcolm-levy/
http://overpasslightbrigade.org
http://www.seanslemon.com